JOURNAL OF CREATION
Vol. 29(3) 2015 ISSN 1036-2916 CREATION.com

FOUR-LEGGED SNAKE FOSSIL:
EVOLUTIONARY STORY STYMIED?

JESUS THE CREATOR
IN THE GOSPEL OF JOHN

Sea anemones and jellyfish turn evolutionary theory into jelly

Baby mammoths asphyxiated in dust storm

REDISCOVERING A YOUNG
PLUTO

JOURNAL OF CREATION

An international journal devoted to the presentation and discussion of technical aspects of the sciences such as geology, biology, astronomy, etc., and also geography, archaeology, biblical history, philosophy, etc., as they relate to the study of biblical creation and Noah's Flood.

COVER: Enhanced image of Pluto captured by NASA's New Horizons spacecraft on 14 July 2015.

PHOTO: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute Laboratory/ Southwest Research Institute

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Printed in Australia,
Published by:
Creation Ministries International Ltd
ABN 31 010 120 304

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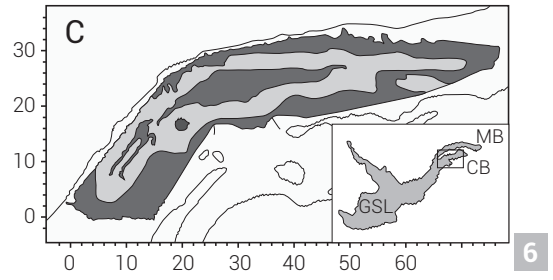
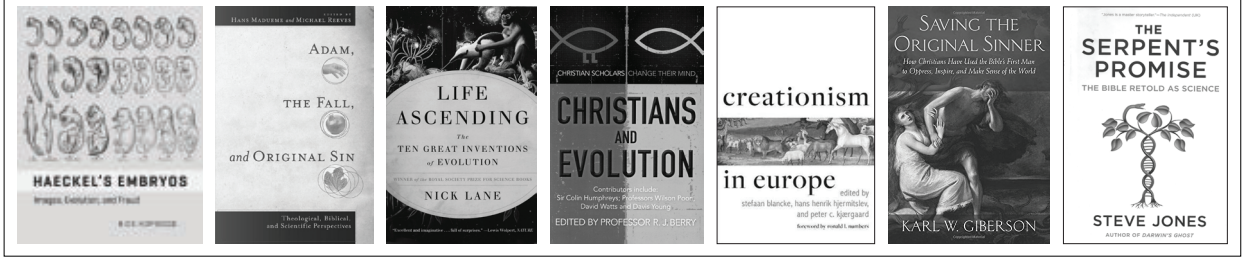


Seismic reflection data and core samples taken from Great Slave Lake support a biblical timeframe and post-glaciation processes

The Palouse Formation in eastern Washington provides data suggesting that the loess could have formed from Flood-deposited mud.

BOOK REVIEWS

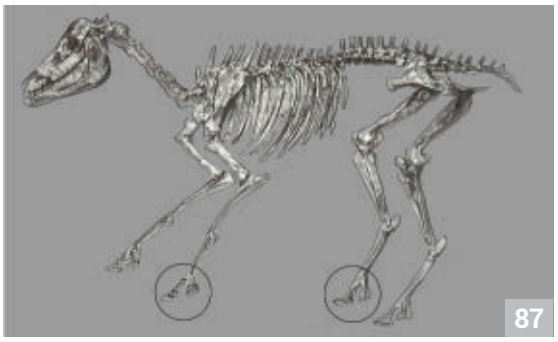
LETTERS



VIEWPOINT

PAPERS

ESSAYS



The proposed transition from early tapir-like hyracothere to Oligocene browsing horse remains specious argumentation at best.

Is viewing Genesis as ancient historical narrative the most consistent Christian reading of Genesis?

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- The account of origins presented in Genesis is a simple but factual presentation of actual events and therefore provides a reliable framework for scientific research into the question of the origin and history of life, mankind, the earth and the universe.
- Scripture teaches a recent origin for man and the whole creation.
- The great Flood of Genesis was an actual historic event, worldwide (global) in its extent and effect.
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Rediscovering Pluto

Wayne Spencer

On 18 February 1930 Clyde Tombaugh discovered Pluto. On 14 July 2015, Pluto was rediscovered through the *New Horizons* mission. The surface of Pluto possesses a fascinating variety of features (figure 1). Astronomers have long wished it were possible to get better information on Pluto, but the wait is now over. Pluto has long raised a number of challenging questions for scientists. Now with the new information from the *New Horizons* mission, much of the science of Pluto has to be rethought. Pluto and its companion Charon turn out to be much more geologically interesting than expected. Though time is needed to digest the new information, there are hints of creation implications from Pluto already that are consistent with other bodies in the solar system, such as moons of the outer planets.

The *New Horizons* mission itself will help us understand the outermost region of our solar system. The *New Horizons* spacecraft travelled for nine years to reach Pluto. To reach such a distant object, *New Horizons* was launched from earth at a greater speed than any other spacecraft to ever leave earth's orbit. The spacecraft travelled at a speed of 15 km per second on its way to Pluto.[1] Thus, *New Horizons* was only able to make one pass by Pluto. It simply wasn't possible to include enough fuel in such a spacecraft to slow it down enough to orbit Pluto or make more than one pass. The *New Horizons* spacecraft is said to be about the size of a grand piano and is packed with a variety of scientific instruments. There is an ultraviolet imaging spectrometer for gas measurements, a special multispectral imaging system for various mapping operations, an infrared spectrometer, a radiometer (for gas measurements), a solar wind detector, a particle spectrometer, a dust collector, and a very high resolution CCD imager with a telephoto lens for taking high quality photos.

The Pluto system

Pluto has five known moons that orbit it as well as other small objects that orbit the sun in or near its orbit (called Plutinos). The largest object orbiting Pluto is Charon (pronounced like 'Sharon'). Pluto and Charon both orbit a centre of gravity located about one eighth the distance from Pluto to Charon. Pluto has a spin axis tilted 122.5 degrees relative to the ecliptic plane (defined by earth's orbit), making it oriented similar to Uranus.[2] Pluto's orbit around the sun is inclined by about 17 degrees with respect to the ecliptic. Charon orbits Pluto with the same orbital period as the spin period of Pluto—approximately 6.4 earth days.[2]

Significant discoveries have already been made by *New Horizons* regarding Pluto and Charon, though data will continue to be transmitted back to earth for months. There are interesting gas phenomena occurring on Pluto and there is evidence of geological activity on the surface. On 10 July 2015, before its closest approach, the NASA team posted a news release saying "Houston, we have geology".[3] This is a loaded statement that implies surprise and challenges to prior assumptions about Pluto. Pluto has often been compared to some of the icy moons of the outer solar system, especially Triton (at Neptune). Scientists have tended to assume that small objects would lose their internal heat after over four billion years and thus they could not still be geologically active. When they are found to be active, it is often assumed that the energy to drive geological processes comes from tidal heating from the planet the moon orbits. But Pluto is not a moon and thus tidal effects cannot be a source of internal heat. In a solar system only several thousand years old, energy could still be dissipating from creation. Scientists may try to appeal to radioactive minerals heating Pluto, but being a relatively small body with a density less than 2.0 g/cm^3, radioactive isotopes are likely to be in short supply. (Note that Pluto was redefined to be a 'dwarf planet' in 2006 by the International Astronomical Union.[4]) Following are some of the important things observed at Pluto by the *New Horizons* spacecraft. Note that these are early results and much more data will be received from the spacecraft in coming months.

- Pluto is losing very large quantities of nitrogen into space. In a NASA Media Briefing on July 17, 2015 one of the researchers said an early estimate was that 500 tons of Nitrogen were escaping Pluto every hour.
- Pluto was found to be somewhat larger than previous estimates. It's diameter is now measured as 2,370 km.[5] This means its density has been revised downward and it has more ice than previously thought.
- The surface has a variety of 'zones' of different characters. There are dark regions along its equator that have more craters, and yet much of the surface is covered with ice and possesses few craters.
- There are other mysterious structures on part of the surface thought to be mounds bounded by crevices. These are referred to by geologists as 'polygonal features'.
- Pluto has mountain ranges. One of the ranges has been compared to earth's Rocky mountains and another to the Appalachian mountains in height. These mountains are believed to be made of water ice.
- Charon (measured to be 1,208 km in diameter) also has an icy surface

that is geologically interesting. It has large canyons and varied terrain.

Ices present on the surface include nitrogen, carbon monoxide, methane, and ethane with nitrogen being the most abundant. (Solid ethane was detected on Pluto in 1999 by the Subaru telescope, with its infrared spectrometer.[6]) The ices on Pluto tend to sublimate (turn directly to gas), especially nitrogen and carbon monoxide. The gases may move across the surface, possibly in a seasonal manner. There may be nitrogen or organic snow. Since Pluto's orbital period is 248 earth years, surface and gas processes probably vary over periods of several decades, as Pluto traverses its orbit.[7] Hazes were observed by *New Horizons* at altitudes of approximately 120 km above Pluto. This puts hazes at a higher altitude than existing models support, according to one scientist.[8] Organic compounds could form from ultra-violet light driving chemical reactions in the gases above the surface and the products from these reactions could make a dark deposit on the surface. As of this writing, without the detailed spectra, it is uncertain what the dark material on the surface is but scientists tend to assume it is a mixture of organic ices, probably including tholins. There is also a dark region near the North Pole of Charon but little data is available on this as yet.

Pluto's surface includes light regions where ice appears fresh as well as dark areas. Some areas have significant topography, with mountains up to to 3,500 m (11,000 ft) in height (figure 2). A large circular or heart-shaped white region (figure 1) has been named the Tombaugh Regio after Clyde Tombaugh, who discovered Pluto. The dark regions on the surface seem older since they possess more impact craters. But much of the surface shows very few craters, which again implies geological activity or some resurfacing phenomena at work. In a region on the edge of the Kuiper belt with a number of small objects in its vicinity including Pluto's five known moons, Pluto was expected to possess more craters. Ice layers on the surface may also be moving. There are also round or polygonal structures on the surface that have apparently been filled with ice. The 'polygonal features' have been seen on other bodies in the solar system, such as near Mars' polar caps. There has been significant debate by geologists on the origin of these structures. They are not likely to be impact structures, but may suggest uplift from below, or perhaps contraction of blocks of ice, or perhaps even convection phenomena under the surface.

Figure 1. Mosaic of Pluto from the *New Horizons* spacecraft, taken 13 July 2015 from a distance of 768,000 km. Prominent 'heart' shaped region is the Tombaugh Regio. NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute.

Conclusions

When something new is discovered or seen for the first time, such as the photos of Pluto from New Horizons, it is natural for there to be some speculation from both scientists and others about implications of the new information. Both evolutionists and creationists have a tendency to interpret things in terms of their own world view. Thus secular scientists look at the surface of an object in our solar system like Pluto, with few craters and they may say it has a 'young' surface. But to someone with a secular evolutionary viewpoint, 'young' may mean a few hundred million years, based on models of cratering rates, for example. But to a young-age creationist, 'young' means only several thousand years. A secular scientist may not assume Pluto formed when the solar system formed, necessarily, but they will assume a much older age than a young-age creation viewpoint. To a scientist, age assumptions then determine the kind of processes that are considered to be likely for explaining the object. In my experience, if there is good quality data, over a period of years research tends to expose problems with evolutionary scientific models. Thus, for Pluto, creationists should watch

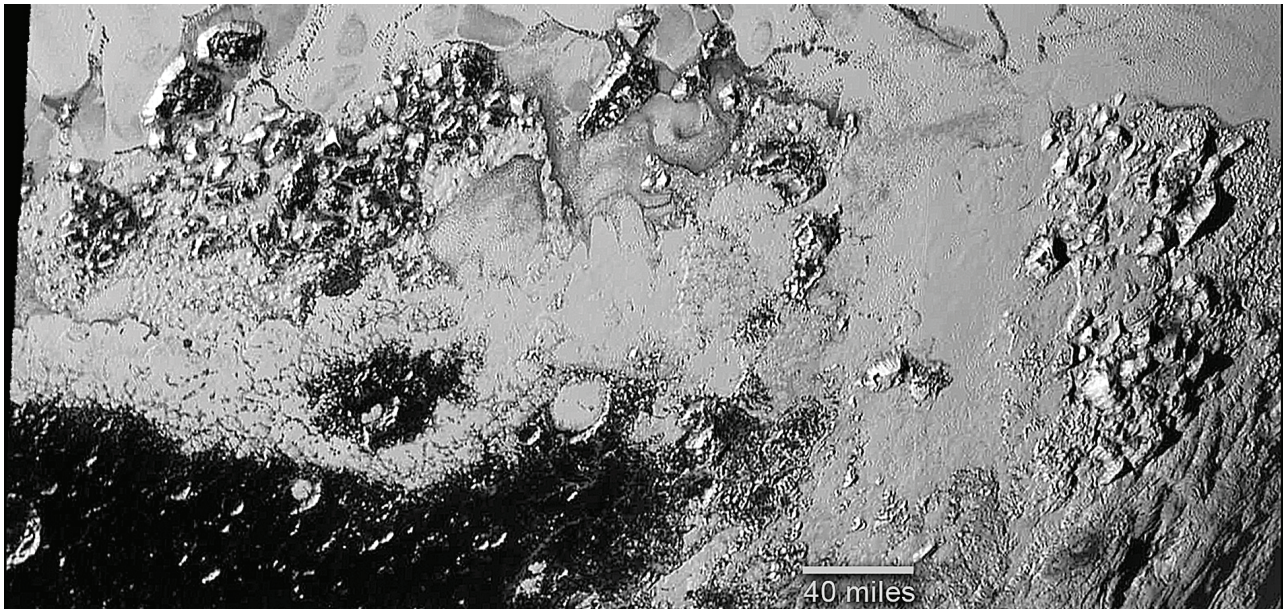


Figure 2. Mosaic close-up of Sputnik Planum area, West of Tombaugh Regio, on Pluto. Taken on 14 July 2015 from 77,000 km. NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute.

the research for the next several years and see where it leads. We should not jump to conclusions too quickly based on too little information. But we can make analogies between Pluto and other similar objects we know of in our solar system, such as moons of the outer planets.

The *New Horizons* spacecraft will continue to send data back to earth for many months to come. The atmospheric and geological phenomena at Pluto are likely to challenge existing theories. Pluto is obviously an active and interesting world which has been partially resurfaced by a variety of processes. In my own research on various solar system objects, a young age creation view often has advantages in explaining surprising observations.[9,10] Energy sources such as radioactive heating, exothermic chemical reactions such as serpentinization, and electrical currents have all been considered for various moons in the outer solar system. These have often been calculated to be inadequate energy sources to explain the active processes occurring in moons such as Europa (Jupiter), Enceladus (Saturn), and Ariel (Uranus).[9] If the solar system were created only several thousand years ago, atmospheric and geological processes could still be 'active' from creation. But over billions of years some processes essentially 'run down' and thus should not be still active. This approach may be applicable to Pluto. However we must first understand better the periodic seasonal processes that may affect Pluto. Scientists and others are making comments about Pluto's surface being 'young'. It could be even younger than most scientists imagine. It is exciting that there are still surprises for us in what God created.

References

1. Phillips, T. (Ed.), New Horizons becomes closest spacecraft to approach Pluto, 3 December 2011, science.nasa.gov/science-news/science-at-nasa/2011/03dec_newhorizons/, accessed 26 July 2015.
2. Williams, D.R., Pluto Fact Sheet, nssdc.gsfc.nasa.gov/planetary/factsheet/plutofact.html, accessed 26 July 2015.
3. "Houston, we have geology", 10 July 2015 news from NASA, Johns Hopkins Applied Physics Laboratory, and Southwest Research Institute, pluto.jhuapl.edu/News-Center/News-Article.php?page=20150710-2, accessed 26 July 2015.
4. Spencer, W., Planet Definitions and the Creator, 10 November 2006, creation.com/planet-definitions-and-the-creator, accessed 26 July 2015.
5. How Big is Pluto? New Horizons Settles Decades-Long Debate, 13 July 2006 news from NASA, Johns Hopkins Applied Physics Laboratory, and Southwest Research Institute, pluto.jhuapl.edu/News-Center/News-Article.php?page=20150713, accessed 26 July 2015.
6. "First detection of extraterrestrial solid ethane", 19 June 1999 Press Release, National Astronomical Observatory of Japan, www.naoj.org/Pressrelease/1999/07/19/index.html, accessed 26 July 2015.
7. Brown, Michael, E., "Pluto and Charon: Formation, Seasons, Composition", *Annual Reviews of Earth and Planetary Science* **30**: 307–345, 2002; DOI: 10.1146/annurev.earth.30.090401.095213.
8. Talbert, T. (Ed.), Stunning Night Side Image Reveals Pluto's Hazy Skies, 24 July 2015 news from NASA, Johns Hopkins Applied Physics Laboratory, and Southwest Research Institute, www.nasa.gov/feature/stunning-nightside-image-reveals-pluto-s-hazy-skies, accessed 26 July 2015.
9. Spencer, W., Warm icy moons, *J. Creation* **29**(3): 53–59, 2015.
10. Spencer, Wayne, "Tidal Dissipation and the Age of Io", *Proceedings of the Fifth International Conference on Creationism*, Robert L. Ivey, Jr (Ed.), Creation Science Fellowship Inc., 2003, pp. 585–595.

Did a lake exist under the north-western Laurentide Ice Sheet?

Michael J. Oard

Researchers were surprised to discover that subglacial lakes with flowing water exist today beneath the Antarctic Ice Sheet.[1] Past study has identified at least 68 lakes under the sheet.[2] Lake Vostok is the largest, measuring 230 km long, 50 km wide, and 600 m deep. The lakes are commonly in deep troughs or basins below the ice. Glaciologists once thought that the pressure gradient beneath the ice sheet should have driven out all of the subglacial water[3] but this is obviously not the case.

The persistence of liquid water under the Antarctic Ice Sheet is explained by its thickness. Although temperatures are well below zero on top of the ice sheet, the ice generally insulates the bottom. Within the uniformitarian ice-age model, as the ice built up, the temperatures at the base slowly warmed by very weak geothermal heat conduction from the interior of the earth.

Postulated subglacial lake underneath the Laurentide Ice Sheet

These findings from the Antarctic have significant ramifications for the Laurentide Ice Sheet that covered central and eastern Canada and the adjacent northern United States during the Ice Age.

Glaciologists are uncertain about how thick the Laurentide Ice Sheet was and whether it had a single dome or multiple domes over Hudson Bay. Nevertheless, most researchers now seem to accept the multiple dome model.[4] Because the ice sheet no longer exists, they have attempted to piece together its characteristics using indirect evidence.

Glaciologists think there must have been subglacial lakes underneath the Laurentide Ice Sheet, since they conclude it was as large as the Antarctic Ice Sheet.[1] The Keewatin ice dome of the Laurentide Ice Sheet is postulated to have been ~4 km thick during the last glacial maximum. The northern portion of this dome was centred over Great Slave Lake in the western North West Territories of Canada (figure 1). Modelling suggests that if the ice dome was greater than 3 km thick, its base would have been wet with meltwater. Therefore, based on uniformitarian assumptions, the high Keewatin ice dome would likely qualify as thick enough to have subglacial lakes after tens of thousands of years of basal warming.

Researchers have proposed one candidate for a subglacial lake in the fault-bounded eastern arm of Great Slave Lake.[5] Great Slave Lake is the sixth deepest and tenth largest lake in the world. It is the deepest in North America with a depth of 614 m in its eastern arm. The lake is 480 km long and varies in width from 109 km to 19 km. The evidence for a subglacial lake is derived from 500 km of seismic reflection data and three 2-m-long sediment cores of the lake bottom sediments from the deep eastern arm (figure 2). However, these sediments are up to 150 m thick and the cores only sampled the very top of the sediments. Unit 1 is interpreted as glacial ground moraine, the only ice-contact deposit in the sediments. Unit 2 is believed to be the lake bottom sediments deposited when the trough was a subglacial lake, and units 3 and 4 are thought to be late-glacial and post-glacial sediments.

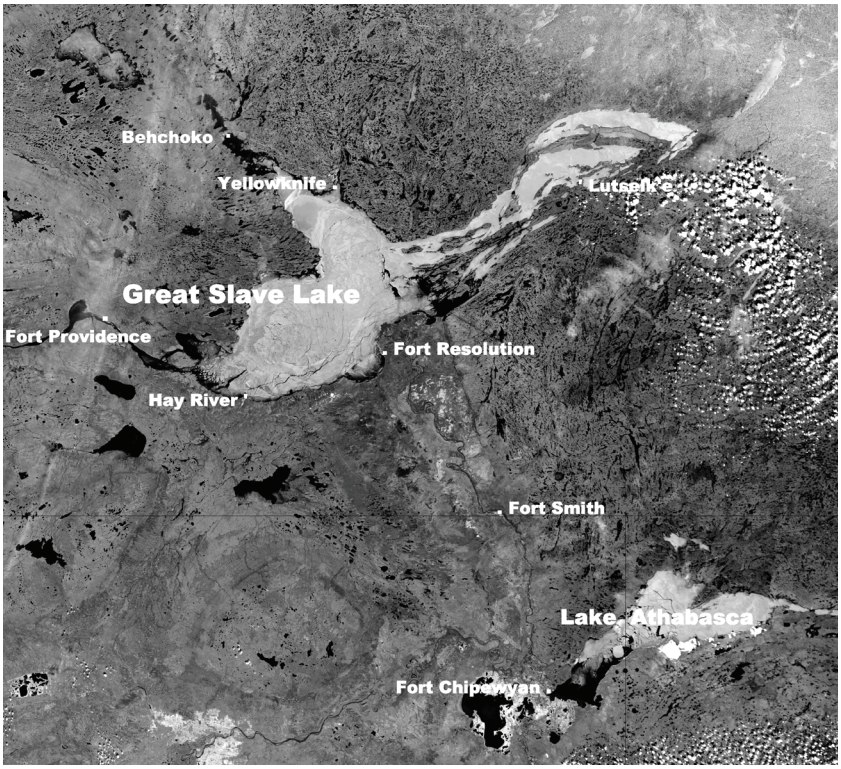


Figure 1. Great Slave Lake (Jacques Descloitres, MODIS Land Rapid Response Team, NASA/GSFC)

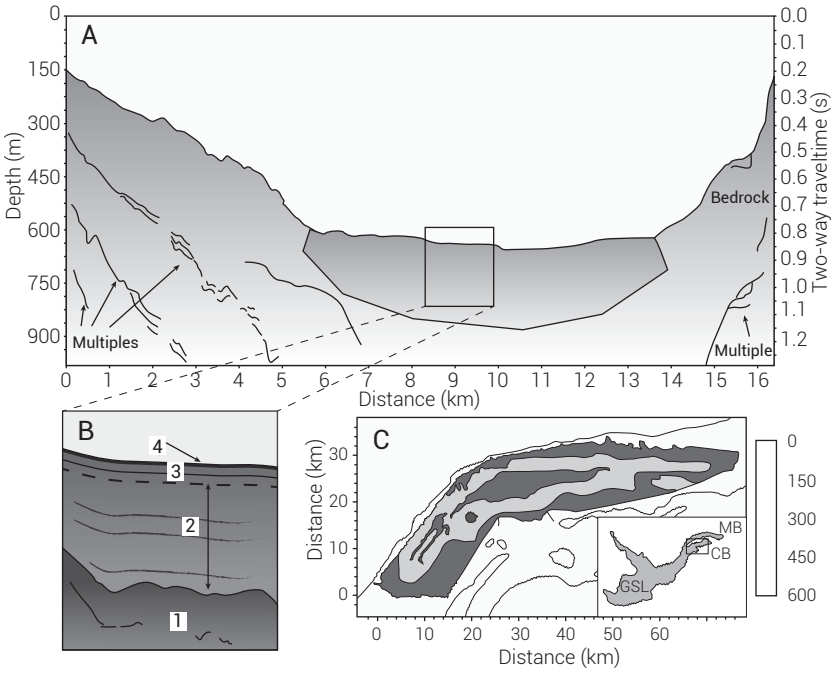


Figure 2. A: Seismic reflection profiles across Christie Bay of the deep eastern arm of Great Slave Lake. Bedrock shows up as the rough surface with unreal multiple reflections of the bottom topography deeper in the rock. B: Close-up of the sedimentary units. C: Bathymetry of Christie Bay (CB). (From Christoffersen *et al.*[1]).

Subglacial lake interpretation questionable

The suggestion of a subglacial lake in Great Slave Lake depends upon the existence of a 4-km-high Keewatin ice dome and the existence of unit 2 in the seismic reflection data. Such a thick ice dome over Keewatin during the Ice Age is unreasonable because the area is very dry today and likely would have been even drier during an ice age as envisioned by uniformitarian scientists, because colder air holds less water vapour. Evaporation from the Arctic Ocean would be of little help since uniformitarian scientists believe the ocean has been capped by sea ice for hundreds of thousands of years.

The scientists did not directly sample unit 2 by bottom cores but unit 2 shows up well on seismic reflection profiles (figure 2). The suggestion that unit 2 represents deposition from a subglacial lake is partly an inference based on the hypothesized thickness of the Keewatin dome.

Creationist interpretations

The creationist model of a rapid, post-Flood Ice Age[6] would also place an ice dome over Keewatin, although it would be significantly thinner than 4 km. The key is that after the Flood the Arctic Ocean would have had no sea ice and been warm. Moreover, North America would have had mild winters and cool summers. Evaporation from the warm water of the Arctic Ocean would be huge and would blanket northern Canada with heavy snow, eventually producing one or more ice domes. It is likely there was another ice dome over the Queen Elizabeth Islands of north-east Canada.

Moreover, the creationist model explains the existence of subglacial lakes under Antarctica without tens of thousands of years of geothermal heat conduction into the base of the ice sheet. In this scenario, the climate would have been much warmer early in the Ice Age than what is observed on top of the Antarctic Ice Sheet today.[7] Meltwater would have filled up troughs early in the Ice Age. The presence of the subglacial lakes are better explained by the warmer oceans during the post-Flood Ice Age, rather than the standard earth history advocated by uniformitarian scientists.

The sediments in Great Slave Lake can also be reinterpreted within the biblical timeframe. Unit 1 has a hummocky surface and so the uniformitarian interpretation that this unit is a ground moraine is likely correct.[8] Units 2 to 4 show no other ice contact features,[9] so they were likely deposited in a lake during deglaciation, possibly even in a subglacial lake. A deglaciation or meltwater deposit is also an alternative interpretation dismissed by the investigating scientists.[10] The fact that the sediments are as thick as 150 m is not unusual, as many lakes in deep troughs in British Columbia that were glaciated show thick deglacial sediments at their base.[11] Moreover, there was a giant deglacial lake called Lake McConnell that covered the area encompassing the present Great Slave Lake.[12] The sediments in these meltwater lakes were possibly deposited from suspended fine-grained material and mass flows along the bottom of the lakes that ended up in the deepest part of the lake.

Finally, sediments on the bottom of Great Slave Lake indirectly support only one ice age, since there is no record of previous ice ages below the moraine sediments and the bedrock (unit 1 in figure 2). Uniformitarian scientists could claim that each ice age scours out deposits from previous ice ages but, within their model, one would expect that some sediment from previous ice ages would remain by being trapped in the deep trough.

Conclusion

There is no need to suspect that a lake existed under the Laurentide Ice Sheet.

Neither is there evidence that this ice sheet was over 4 km deep or that there were multiple glaciation periods. The seismic reflection data and the core samples taken from Great Slave Lake support a biblical timeframe and post-glaciation processes.

References

1. Christoffersen, P., Tulaczyk, S., Wattrus, N.J., Peterson, J., Quintana-Krupinski, N., Clark, C.D. and Sjunneskog, C., Large subglacial lakes beneath the Laurentide Ice Sheet inferred from sedimentary sequences, *Geology* **36**(7):563, 2008.
2. Vincent, W.F., Icy life on a hidden lake, Science **286**:2094–2095, 1999.
3. Oswald G.K.A. and Robin, G. de Q., Lakes beneath the Antarctic Ice Sheet, *Nature* **245**: 251–254, 1973.
4. Oard, M.J., The Laurentide Ice Sheet was thin, *J. Creation* (in press).
5. Christoffersen *et al*., ref. 1, pp. 563–566.
6. Oard, M.J., *Frozen in Time: Woolly Mammoths, the Ice Age, and the Biblical Key to Their Secrets*, Master Books, Green Forest, AR, 2004.
7. Oard, M.J., Little erosion beneath Antarctica and Greenland Ice Sheets, J. Creation (in press).
8. Some uniformitarian interpretations are true but they must be evaluated within the biblical Creation/Flood model.
9. Christoffersen *et al*., ref. 1, p. 565.
10. Christoffersen *et al*., ref. 1, pp. 264–265.
11. Eyles, N., Mullins, H.T. and Hine, A.C., Thick and fast: sedimentation in a Pleistocene fiord lake of British Columbia, Canada, Geology **18**:1153–1157, 1990.
12. Smith, D.G., Glacial Lake McConnell: paleogeography, age, duration, and associated river deltas, Mackenzie River Basin, western Canada, *Quaternary Science Reviews* **13**: 829–843, 1994.

Standard snake evolution story stymied by spate of fossil discoveries

Philip Bell

Until early 2015, the 'earliest' date reported for a fossil snake was less than 100 Ma old. In January, a team led by University of Alberta (Canada) paleontologist Professor Michael Caldwell described fossils of four new species, in *Nature Communications*, which they claimed extended the snake fossil record backwards by about 70 Ma to the Middle Jurassic.[1]

'Earliest' snake fossils

The new species reported were:

- *Parviraptor estesi* (from Dorset, England)—145–140 Ma
- *Diablophis gilmorei* (from Colorado, USA)—155 Ma
- *Portugalophis lignites* (from Guimarota, Portugal)—157–152 Ma
- *Eophis underwoodi* (from Oxfordshire, England)—167 Ma.

The skull anatomy of all four of these 'ancient' snakes, they say, is similar to that of both modern snakes and other fossil snakes. Of course, this is unexpected. However, the skull structure of previously reported fossil snakes, *Pachyrhachis problematicus* and *Haasiophis terrasanctus*, also surprised evolutionary researchers, resembling that of modern boas and pythons (deemed 'advanced'). Furthermore, the latter two species were preserved with actual fossilized hind limbs (considered a 'primitive' condition).[2] It was anticipated that fossils of earlier snakes would turn out to have more pronounced hind legs as well as front legs. So what of the four species reported by Caldwell's team?

Reuters published artistic renditions of three of the species, picked up by media outlets globally.[3] *Diablophis gilmorei* was pictured with diminutive hind legs *and* forelegs and *Portugalophis lignites* as a colourful tree climber with the suggestion of tiny forefeet.

Unknown to most readers of the popular new reports was that these limbs and feet were sheer artistic licence. No trace of limbs or feet was reported by Caldwell *et al.*, neither was there any trace of pectoral or pelvic girdles! The systematic description of skeletal and dental specimens for *Diablophis gilmorei* included little of the backbone itself—just some precloacal[4] vertebrae and "one possible sacral vertebra".[5] Similarly, *Portugalis lignites* was reconstructed solely from fragmentary jaw remains. In fact, the fossil material of all four species was acknowledged to be so incomplete[6] that "we cannot ascertain the shape, length, form and so on of *any aspect* of the body of the earliest snakes (~167 Myr ago) reported herein [emphasis added]". This did not prevent the researchers speculating that "all four may have had some form of reduced forelimbs and hind limbs".[2]

New insights and a new story?

There have long been two competing ideas for the origins of snakes. Some researchers have held that snakes are descended from monitor lizards which, in turn, descended from mosasaurs (an aquatic origin). The other view (a terrestrial origin), has gained ascendancy, with land lizards being deemed the snake ancestors.[7] Commenting on these oldest fossil snakes, the writer for Reuters exclaimed: "The remarkable fossils ... rewrite the history of snake evolution."[3] Caldwell *et al.* were more cautious but did claim that the new fossils "provide insights on snake evolution".[1]

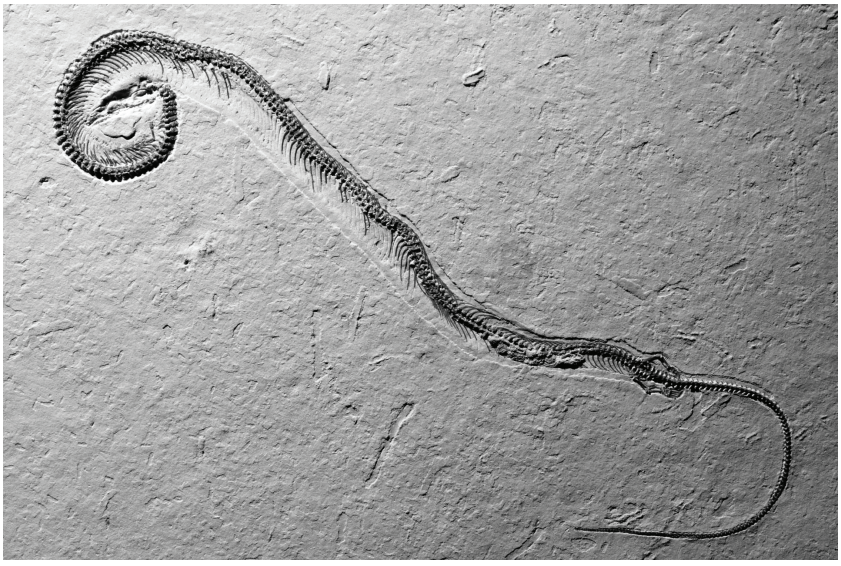


Figure 1. *Tetrapodophis amplectus*—literally 'four footed snake' with an 'embrace'

In fact, the dates assigned to the new fossils posed something of a dilemma, as Caldwell acknowledged: "Importantly, there is now a significant knowledge gap to be bridged by future research, as no fossils [sic] snakes are known from between 140 to 100 Ma ago"[8] (but see later). If mature, bologically diverse snakes (with 'advanced' crania) already existed by 167 Ma ago (the 'age' of the oldest fossil), evolutionary paleontologists now had little option but to argue for an even earlier origin for snakes. One of Caldwell's colleagues, Sebastián Apesteguía (from the National Scientific and Technical Research Council, Argentina), believes snakes must have first appeared about 190 Ma ago.[3]

The evolutionary story was further stymied by the lack of hard evidence for limbs or limb girdles.[9]

Caldwell's team advanced the 'revolutionary' view that the snakes evolved their characteristic skull morphology long *before* losing their legs.[10] They had little choice in taking this step for two reasons: (1) the modern-looking skulls of all four of these 'oldest' snakes; (2) the fact that much 'younger' snakes (such as the 94-Ma-old *Eupodophis*[11]) had small hind limbs. It wouldn't do to argue for an evolutionary reversal having occurred (the loss, then regaining of limbs over millions of years violating Dollo's Law[12]), so although these early snakes *appear* to have been limbless (based on the fossils alone) it is presumed that they possessed legs, front and back. During the 70 Ma of time between *Eophis underwoodi* and the younger hind-limbed snakes, snakes were envisaged to have been diversifying geographically and biologically, principally by virtue of elongation of the body and reduction in size of the legs.

First four-legged snake

In July, a further species of fossil snake was reported in *Science*:[13]

- *Tetrapodophis amplectus* (from Brazil)—113 Ma.

A complete skeleton of the animal is preserved (figure 1), in contrast to the much more fragmentary fossil remains of the four 'older' species. The creature possessed 160 spinal and 112 tail vertebrae and beautifully preserved hind limbs and forelimbs. Ironically, this exquisite fossil has created a quandary for researchers in this field—confusion rather than clarity. Some are even cautious about whether *Teptrapodophis* is actually a true snake, with Michael Caldwell (author of the earlier 2015 paper[1]) even suggesting it may belong to an extinct amphibian group.[14] Nevertheless, the media proclaimed it a four-legged snake. Evolutionary developmental biologist Prof. Martin Cohn claimed: "this could be one of the most important fossils ever found. The combination of snake-like body with complete forelimbs and hindlimbs is like a snake version of *Archaeopteryx*."[15]

Even accepting it as a true snake, *Tetrapodophis* is somewhat problematic for the conventional evolutionary view. Yes, it partially narrows the approx. 40 Ma 'time gap' mentioned earlier. However, *Tetrapodophis* is certainly not morphologically transitional between those 'earliest' (limbless) snakes and the later snake fossils with hind limbs; namely *Pachyrhachis problematicus*, *Haasiophis terrasanctus* and *Eupodophis descouensi*—notwithstanding that evolutionists will have to claim that the 'earliest' fossil snakes also had four limbs—and larger ones at that. Speaking of the limbs of *Tetrapodophis*, one of the authors of the *Science* paper, Dr Nick Longrich (University of Bath, UK), says they were "far from being 'vestigial' evolutionary leftovers, dangling uselessly".[16] Instead, it is believed that *Tetrapodophis* used its long, clawed fingers and toes for grasping onto its prey, conveyed by the species name *amplectus*, meaning 'embrace'. This was portrayed in artistic reconstructions of the creature. Even the preserved remains of its last meal were fossilized, some sort of small vertebrate.

The five 'ancient' snake species reassessed

However the debate on this fascinating little creature pans out, the fact remains that, from an evolutionary perspective, the fossils fail to furnish the evidence for their story. The

'earliest' snake fossils appear mature, 'advanced', and limbless. 54 Ma after their first appearance in *Eophis underwoodi*, *Tetrapodophis amplectus* turns up with four fully functional legs and feet! It is now imperative that evolutionary paleontologists find much 'older' fossil snakes (about 190 Ma) showing *much more* developed hind legs and forelegs (and associated pelvic and pectoral girdles respectively) than observed in *Tetrapodophis amplectus*. In addition, such creatures should show much less body elongation than in 'later' snakes.

Creation affirmed

Evolutionary paleontologists will continue to seek fossils which definitively answer the conundrum of snake origins. The snake fossil record *still* says no to evolution! From a creationist perspective, the four oldest fossils are likely the remains of the types of snakes we would readily recognize in today's world. *Tetrapodophis* is part of the rich antediluvian diversity that is now lost to us; assuming some of its kind passed (via the Ark) into the post-Flood world, they appear to have long since gone extinct. Its limbs exhibit clear evidence of purposeful design. Even if they were diminished in size from an ancestral condition, this would be *de*volution. The *loss* of legs (gradually or quickly) in snakes or lizards no more poses a challenge to biblical biology than does the loss of functional wings in flightless insects[17] or birds.[18]

References

1. Caldwell, M. W. *et al*., The oldest known snakes from the Middle Jurassic-Lower Cretaceous provide insights on snake evolution, *Nature Communications* **6**, (5996), 27 January 2015; doi:10.1038/ncomms6996.
2. Whitehouse, D., Discovery challenges snake origins, news.bbc.co.uk, 17 March 2000; accessed 30 June 2015.
3. Dunham, W., Remarkable fossils push back snake origins by 65 million years, uk.reuters.com, 27 January 2015; accessed 5 February 2015.
4. The cloaca is the shared opening for the expulsion of faecal matter and urine, also used during copulation. Precloacal vertebrae are those back bones which are close to, but in front of, the cloaca.
5. See ref. 1. The sacral part of the backbone is the region where a pelvic girdle would be supported if there was one.
6. The photographs and illustrations appearing in the paper's illustrations are restricted to details of skull and jaw elements (plus teeth) and comparisons of vertebral bones. One can be sure that any pelvic or limb elements would have taken pride of place, had they been found.
7. Bell, P., Of snakes, lizards and mosasaurs—evolutionists puzzle over snake origins, *Creation* **31**(3):15–17, 2009; creation.com/snakes.
8. University of Alberta, The world's oldest known snake fossils: rolling back the clock by nearly 70 million years, www.sciencedaily.com, January, 2015; accessed 5 February 2015.
9. The best they could offer was "one potential sacral vertebra in *Parviraptor estesi*" (in contrast to most other snakes) and "another in the vertebral specimens referred to *Diablophis gilmorei* ...". That these were robust led them to speculate about "the possible presence of robust pelvic girdles and hind limbs".
10. This is the opposite of the conclusion of a recent paper on the fossil snake Coniophis precedens; Longrich, N.R., Bhullar, B.–A.S. and Gauthier, J.A., A transitional snake from the Late Cretaceous period of North America, *Nature* **488**:205-208, 2012.
11. Sarfati, J., Another leggy snake? What should creationists think? 29 April 2008; creation.com/another-leggy-snake.
12. Dollo's Law is named after Belgian biologist Louis Dollo. Another example of a violation of this 'law' relates to the alleged evolutionary loss, reappearance and loss (again) of the wings of stick insects; Bell, P., Evolution revolution, *Creation* **25**(3):31, 2003; creation.com/evo-revo.
13. Marthill, D.M., Tischlinger, H. and Longrich, N.R., A four-legged snake from the Early Cretaceous of Gondwana, *Science* **349**(6243):416–419, 24 July 2015.
14. Perkins, S., Four-legged snake fossil stuns scientists—and ignites controversy, news.sciencemag.org, 23 July 2015.
15. Christakou, A., Four-legged fossil snake is a world first, www.nature.com/news, 23 July 2015.
16. Webb, J., Four-legged snake ancestor 'dug burrows', bbc.co.uk/news, 24 July 2015.
17. Catchpoole, D. and Wieland, C., Researchers: Evolution of insect flight? 19 June 2012; creation.com/insect-flightlessness.
18. Cosner, L. and Sarfati, J., The birds of the Galápagos, *Creation* **31**(3):28–31, 2009; creation.com/galapagos-birds.

Trees in Northwest Scandinavia during the Ice Age

Michael J. Oard

Ice ages within the uniformitarian paradigm are very cold, much colder than today. So, according to this paradigm, it is believed that during the last ice age Scandinavia was completely denuded of trees[1] and their range shrank as far south as the Mediterranean region.[2] Trees did not make a comeback in Scandinavia until after the ice melted some 9,000 years ago, within the uniformitarian time scale. However, the fossil evidence suggests otherwise.

Pine and spruce found in central and northern Norway during the Ice Age

Pine and spruce DNA and pollen are now found in central and northern Norway at the time of the last ice age.[3] They are believed to have survived in small ice-free pockets or refugia for tens of thousands of years and then spread to other areas of Scandinavia once the ice melted. The researchers write:

> "Coupling our findings with the results of previous megafossil based analyses[(10)], the overall evidence for presence of conifer trees in Scandinavia during the last glaciation seems the only explanation for our observations."[4]

This result accords with the finding of spruce and pine megafossils in the mountains of central Scandinavia, and of trees in the tundra of Alaska, the Yukon, Siberia, and Estonia during the last ice age.[5] These discoveries

are challenging some concepts of the Scandinavian Ice Sheet and suggest the possibility of an ice free corridor during glacial maximum along the coast of northern Scandinavia and the Kola Peninsula to the east.[6] The cause of such ice free conditions or a series of nunataks, peaks that stick above the ice, is the relatively temperate conditions of the Atlantic Ocean. But within the cold uniformitarian ice age in which sea ice expands well south of Norway, an ice free corridor is questionable. Regardless, the ice age fossils are difficult to explain within the uniformitarian paradigm.

Creationist Ice Age explanation

Such a discovery is not surprising within the creationist ice age model.[7] This model begins right after the Flood with very warm sea surface temperatures, even at high latitudes. The Arctic Ocean would likely have been warm enough to swim in at this time. Such warm sea surface temperatures would warm and moisten the air, which in turn would warm the adjacent continents along the Arctic Ocean and the west coasts of Europe and North America. This is because the average atmospheric flow is from west to east. Although sea surface temperatures would have cooled fast in the north, the mild winters and cool summers (caused by volcanic aerosols in the stratosphere) would have been conducive to tree growth along the edge of the Arctic Ocean and in western Norway for a while. So, it stands to reason that the coast areas of Norway and the Kola Peninsula would have trees growing for a few hundred years at the beginning of the Ice Age.

Such warm sea surface temperatures also mean that the Scandinavian Ice Sheet was not as extensive as uniformitarian scientists believe. With warm, moist onshore flow, the ice would have developed rapidly over the Scandinavian mountains. The ice would have slowly spread toward the ocean but with cooler sea surface temperatures and sea ice developing with time, the ice would have been thinner than uniformitarian estimates at glacial maximum. This is probably why the Lofoten Islands about 68°N latitude off the northwest coast of Norway had only local, thin ice glaciers that spread out from the mountains (figure 1). Since the ice caps spread from the mountains toward the east, it implies that the continental ice sheet was not as thick over the coastal areas of Norway as uniformitarians scientists believe.

Figure 1. The southern Lofoten Islands off the northwest coast of Norway showing evidence of thin mountain ice (view northwest). In the foreground is a small fjord with low altitude ice sculptured granite or gneiss (whaleback forms) that came from local mountain glaciers flowing southeast towards the viewer. Notice that the higher mountains are steep and pointed, indicating only thin ice.

References

1. Anonymous, Sturdy Scandinavian conifers survived ice age, *Science Daily*, 1 March 2012, www.sciencedaily.com/ releases/2012/03/120301143737.htm.
2. Svenning, J.-C., Normand, S. and Kageyama, M., Glacial refugia of temperate trees in Europe; insights from species distribution modelling, *J. Ecology* **96**:1117–1127, 2008.
3. Parducci, L. *et al.*, Glacial survival of boreal trees in northern Scandinavia, *Science* **335**: 1083–1086, 2012.
4. Parducci *et al.*, ref. 3, p. 1085.
5. Parducci *et al.*, ref. 3, p. 1083.
6. Parducci *et al.*, ref. 3, p. 1084.
7. Oard, M.J., *Frozen in Time: Woolly Mammoths, the Ice Age, and the Biblical Key to their Secrets*, Master Books, Green Forest, AR, 2004.

Evidence some woolly mammoths asphyxiated from dust

Michael J. Oard

Occasionally, observational data provides confirmation of creationist predictions. An example is the prediction by Humphreys of the magnetic fields of the solar system planets.[1,2] Another is the prediction that some woolly mammoths in the permafrost of Siberia, Alaska, and the Yukon Territory of Canada died of asphyxiation while breathing blowing dust.[3,4]

The prediction of death by breathing blowing dust

The top of the thick permafrost found in Siberia, Alaska, and the northwest Yukon Territory of Canada is frozen loess. Loess is mostly composed of silt from blowing dust but has a small proportion of clay and sand. Woolly mammoths are predominantly interred in loess in the lowlands in these areas. It is interesting to note that during the Ice Age these lowlands were never glaciated. It is difficult for climate models to produce glaciation, but some models, if tweaked enough, will produce glaciation, even over Alaska and Siberia, both mountains and lowlands.[5] Years ago, I deduced that some Ice Age woolly mammoths and other animals were most likely asphyxiated by breathing blowing dust, before the animals froze. At the time, there was no evidence that some of the animals died by suffocation.

At the end of the Ice Age, dry, windy storms blew vast amounts of dust over huge areas of the world and deposited the dust in thick layers. The dust storms would have been generated by a combination of factors, including increased sea ice. The sea ice would have cooled the air and reduced oceanic evaporation, resulting in cold, dry air in the mid and high latitudes. The effect would have caused colder winters than today with little additional snowfall, but summers would have been warmer with more sunshine, resulting in net melting of the ice sheets.

At the same time the subtropics were becoming warmer. The north–south temperature difference between high and low latitude would have been significantly greater than it is today. A basic principle in atmospheric science is that temperature differences drive the jet stream. The westerly winds aloft would have generated powerful surface winds. The wind, in combination with the colder, drier atmosphere at the end of the Ice Age, would have caused intense dust storms over much of the Northern Hemisphere. These conditions would have been further enhanced by the passage of cold fronts when the winds aloft descended to the surface. These horrible conditions can account for the mass extinctions that took place on all continents at that time. Mass extinctions are another mystery for uniformitarian science, especially since it holds that deglaciation would have improved the climate and expanded the grazing territory.

After the ice sheets melted, the unique atmospheric conditions would have ceased. Warmer temperatures in the Arctic region would have melted some of the permafrost. Local melting would have formed hollows and lakes, but most of the woolly mammoths and other animals would still remain interred in the residual hills, called yedomas or edomas.

Two baby mammoths died of asphyxia by inhaling 'mud'

Two very complete baby woolly mammoths have recently been found in Siberia. The frozen mummy of 'Lyuba' was found in 2007 along the banks of the Yuribey River in the Yamal Peninsula of northwestern Siberia.[6] 'Khroma' was found in 2008 in northeast Siberia.[7] They both died at one to two months old and were well fed at the time based on the abundance of fat and the milk residues in their stomachs.

The baby mammoths have undergone extensive analyses using sophisticated technologies. As a result scientists have been able to extend their (previously incomplete) analysis. They discovered that both mammoths died of asphyxia after aspirating 'mud'.[7,8] Mud is technically defined as a combination of silt and clay, but sand[9] was also found. The mud was packed extensively in Lyuba's mouth, oral cavity, trunk, and lungs. Although most of Khroma's trunk and lungs were scavenged, the CT scan was able to show a column of sediment packed her trachea, oral cavity, and nasal passages.[7]

Mammoths did not drown

At first researchers thought the findings indicated death by drowning, but it soon became apparent that neither animal died by drowning.[7,8] The abundant milk in the stomach of Lyuba cannot be explained by drowning: "… she could not have drunk milk *after* drowning … [emphasis in original]".[10] Moreover, the lung sediments were not due to post-mortem entry by perforation. Additionally, the distribution of blue-coloured vivianite, a hydrated iron phosphate mineral, showed that Lyuba did not drown.[11] The packing of sediments into the breathing structures is also unexpected during drowning.

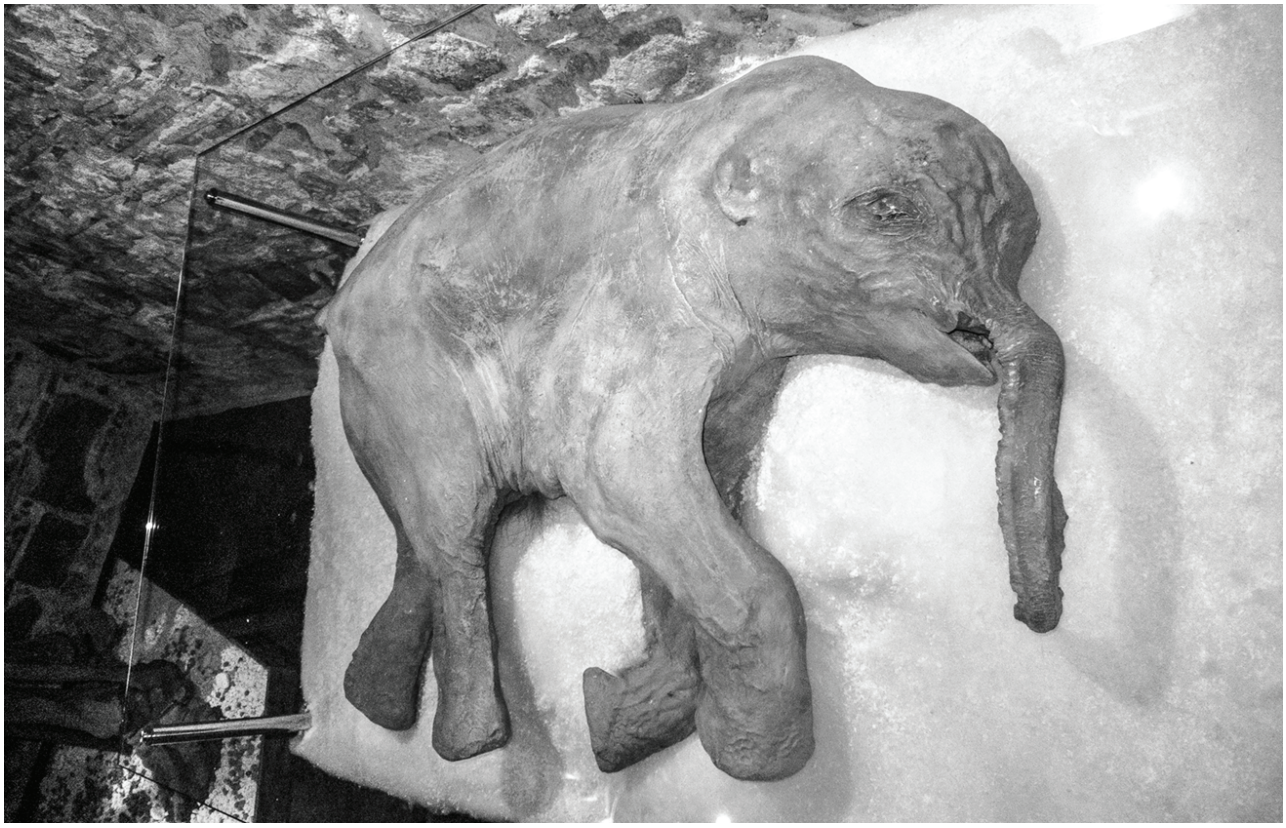


Figure 1. Cast of Lyuba, a baby mammoth found in Siberia, from Barcelona, Spain

The wild guess of asphyxiation by mud

The researchers felt a need to define a cause of death that met these facts. They concluded that both mammoths died by ingesting mud:

> "As an alternative to drowning, we propose that Lyuba died of asphyxia or breathing dust after forceful, reflexive inhalation of a viscous 'mud' composed of the fine-grained vivianite that now occupies her trachea and bronchi."[10]

They suggest that Khroma could have asphyxiated in a mud flow or a river bank collapse.[12] However, some researchers have commented that their scenario is inconceivable for Lyuba because her mother would have rescued her, which the researchers acknowledge could be the case.

The researchers further propose that Lyuba must have ingested mud from a lake because the sediment had to have been packed with the aid of water:

> "…but our central tenet is that there is no force other than the reflexive inhalation of a frantic animal that would be capable of drawing a continuous column of sediments into the airways. … If this material had been suspended in a liberal amount of water, it would have been carried more pervasively into peripheral parts of the lung."[11]

Creationist considerations

I believe a post-Flood rapid Ice Age provides a better explanation of the facts.

Death by dust storms

The mammoth data can be explained better by their inhaling wind-blown dust. This could have easily packed the mammoths' breathing apparatus and caused a well-fed, healthy woolly mammoth to asphyxiate. The dust would be interpreted as mud by uniformitarian scientists. Death by severe dust storms would not be considered because they believe the area was mostly wet tundra, as it is today. This would make dust deposition a local and, at best, insignificant event. However, severe dust storms would have been pervasive at the end of the post-Flood rapid Ice Age. The fact that the two woolly mammoths were found 5,000 km apart indicates the extent of the dry, cold, windy climate.

Rapid interment into permafrost

Uniformitarian scientists wonder how the animals could have been interred in the permafrost and yet still remain in excellent condition. They propose that their decay was inhibited for years as the corpses were somehow gradually incorporated into the permafrost:

> "This process could have retarded breakdown of soft tissues, permitting Lyuba's body to remain intact during the interval of time—possibly years long—during which Lyuba's death and burial site was gradually incorporated into permafrost."[13]

However, this is a general statement with no support.

The creationist model predicts that moderate dust storms would gradually have covered animals that died from the climate change, preserving their bones and tusks in excellent condition. However, severe dust storms would have resulted from the passage of a strong, dry cold front. These dust storms could easily have suffocated and buried the animals, with some in a general standing position. The cold temperatures would have frozen them quickly from the cold air above and from the permafrost below as it would gradually have risen to incorporate the newly laid dust. The freezing process would have been fast enough in some cases to preserve carcasses from decay. This model provides a better explanation of why the mammoths' lungs and stomachs were filled with 'mud'.

Broken bones from permafrost faulting

The baby mammoths also had broken bones. Lyuba had jaw fractures and Khroma, a mid-thoracic fracture. These bones are large and dense and not easily broken. Although a bank collapse is suggested for Khroma's burial, it is questionable whether a mudflow could break large bones. More importantly, a bank collapse does not explain how dust or mud was packed deep into Khroma's breathing apparatus and stomach, after burial. It has been suggested that Lyuba's broken bones are a result of permafrost processes.[14] I agree, permafrost faulting is the best explanation for Lyuba's broken bones. It also explains Khroma's injuries.

What is the origin of the loess?

Another perplexing observation is the sponge spicules found in the ingested 'mud' of both mammoths. Sponges are normally marine organisms, but they are also found in some freshwater lakes. Spicules are (often needle-like) skeletal structures left over after a sponge decays. The researchers automatically assumed the sponges came from a freshwater environment.

Uniformitarian science has a difficult time explaining the massive amount of loess that is found in the lowlands of Siberia, Alaska, and the Yukon Territory. It is much greater than the glacial grinding of bedrock in the mountains could generate because glacial grinding is an inefficient process for creating loess.[15] The origin of the loess, which can be up to 60 m thick in river valleys, requires an alternative explanation.

Loess could result from reworked mud that was deposited by the retreating floodwater.[15] After the mud dried, strong winds at the end of the Ice Age would have caused some redeposition. The sponge spicules would have been in the original mud from the Flood.

The Palouse Formation in eastern Washington, USA, provides data suggesting that the loess could have formed from Flood-deposited mud. The Palouse 'loess', or formation,[16] averages about 30 to 40 m thick. It is considerably more extensive than would have come from postulated glacial grinding. Dr Harold Coffin discovered abundant sponge spicules at all 19 locations he sampled within the Palouse 'loess'.[17] Furthermore, the lower layers of the Palouse 'loess' contain rounded, coarse gravel, indicating water deposition. The top of the Palouse formation would have been reworked by wind after the Ice Age. Palouse sponge spicules provide a clue as to the Flood origin of the original mud, both in eastern Washington and in the far north.

References

1. Humphreys, D.R., The creation of planetary magnetic fields, *Creation Research Society Quarterly* **21**(3):140–149, 1984.
2. Humphreys, D.R., Mercury's magnetic field is young, *J. Creation* **22**(3):8–9, 2008.
3. Oard, M.J., *Frozen in Time: Woolly Mammoths, the Ice Age, and the Biblical Key to Their Secrets*, Master Books, Green Forest, AR, 2004.
4. Oard, M.J. and Oard, B., *Uncovering the Mysterious Woolly Mammoth: Life at the End of the Great Ice Age*, Master Books, Green Forest, AR, 2007.
5. Phillipps, P.J. and Held, I.M., The response to orbital perturbations in an atmospheric model coupled to a slab ocean, *J. Climate* **7**:767–782, 1994.
6. Kosintsev, P.A., Lapteva, E.G., Trofimova, S.S., Zanina, O.G., Tikhonov, A.N. and Van der Plicht, J., Environmental reconstruction inferred from the intestinal contents of the Yamal baby mammoth Lyuba (*Mammuthus primigenius* Blumenbach, 1799), *Quaternary International* **255**:231–238, 2012.
7. Fisher, D.C., Shirley, E.A., Whalen, C.D., Calamari, Z.T., Rountrey, A.N., Tikhonov, A.N., Buigues, B., Lacombat, F., Grigoriev, S. and Lazarev, P.A., X-ray computed topography of two mammoth calf mummies, *J. Paleontology* **88**(4): 664–675, 2014.
8. Fisher, D.C., Tikhonov, A.N., Kosintsev, P.A., Rountrey, A.N., Buigues, B. and Van der Plicht, J., Anatomy, death, and preservation of a woolly mammoth (*Mammuthus primigenius*) calf, Yamal Peninsula, northwest Siberia, *Quaternary International* **255**:94–105, 2012.
9. Van Geel, B., Fisher, D.C., Rountrey, A.N., Van Arkel, J., Duivenvoorden, J.F., Nieman, A.M., Van Reenen, G.B.A., Tikhonov, A.N., Buigues, B. and Gravendeel, B., Palaeo-environmental and dietary analysis of intestinal contents of a mammoth calf (Yamal Peninsula, northwest Siberia), *Quaternary Science Reviews* **30**:3935–3946, 2011.
10. Fisher *et al.*, ref. 8, p. 100.
11. Fisher *et al.*, ref. 8, p. 103.
12. Fisher *et al.*, ref. 7, p. 673.
13. Fisher *et al.*, ref. 8, p. 104.
14. Fisher *et al.*, ref. 8, p. 98.
15. Oard, M.J., Loess problems, *J. Creation* **21**(2): 16–19, 2007.
16. Lowry, W.D. and Baldwin, E.M., Late Cenozoic geology of the Lower Columbia River Valley, Oregon and Washington, *GSA Bulletin* **63**:12, 1962.
17. Coffin, H.G., The Miocene/Pleistocene contact in the Columbia Basin: time implications, *Origins* **53**:39–52, 2002.

The definitive work on a sordid affair

Haeckel's Embryos: Images, Evolution, and Fraud

Nick Hopwood

The University of Chicago Press, 2015

Jerry Bergman

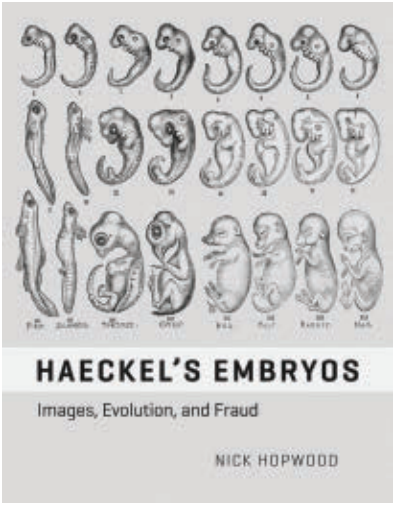
Professor Ernst Haeckel (1834–1919) is most well known for his drawings that supported his 'biogenetic law', the idea that embryos and fetuses of higher-level organisms passed through the evolutionary stages when developing in the mother's womb.[1] Later, the drawings were used to argue for an evolutionary phylotypic stage, where embryos of different vertebrate classes supposedly resemble one another very closely at a certain stage of development, supposedly supporting common ancestry. Consequently, the development of the child in the womb was seen as proof of the evolution of humans from a single-celled organism to modern humans. Haeckel also played an important role in supporting biological racism, a topic that Hopwood also covered.

This new study by science historian Nick Hopwood, Reader[2] in History of Science and Medicine at the University of Cambridge, promises to be the definitive work in the history of a set of drawings of embryos that have survived as evidence for Darwin's theory for over 100 years, even though the drawings were known to be problematic almost from their inception. The inaccurate embryo illustrations, which were often not credited to Haeckel, were almost universally reproduced in biology textbooks even though, as early as 1900, "no competent scientist had defended them for decades" (p. 262). One common source of the biogenetic law drawings, including the illustration on the cover of Hopwood's book, was Romanes, which was credited to 'Häckel' on pages 152–153.[3]

Hopwood examined both how and why Haeckel made his drawings, and their exploitation to prove Darwinism true for over a century after they were first published. His detailed detective work even included researching the Haeckel archives in Jena, evaluating the original drawings, as well as the woodblocks that were used to print his embryo illustrations and other pictures. The result was, according to a book review by Matthew Cobb, Professor[4] of Zoology at the University of Manchester, UK, that it is "embarrassing but true: some of the most influential drawings in the history of biology are wrong, exaggerated to fit a thesis".[5] Cobb continues:

> "Haeckel wanted to convince his readers that all vertebrates share a common ancestor, and that, as he put it, 'ontogeny recapitulates phylogeny'—our embryonic development repeats our evolutionary past. This aphorism was soon disproved, but the use of Haeckel's drawings persisted, particularly in education. There were waves of criticism, from the 1870s when the drawings were published, up to 1997 as Haeckel's 'fraud' was rediscovered and exploited by creationists."

The author documented the fact that a set of pictures printed in a German book in the 1870s have been reprinted, either the original or copies, thousands of times in hundreds of books, even in a major paleontology college textbook as



late as 1997.[6] A fuzzy illustration of the embryo drawings even made the cover of the 9 December 2010 issue of *Nature* magazine[7] (p. 297) without acknowledging any of their problems, even though, as a review of Hopwood's book published in *New Scientist* proclaimed, they were "drawn-out lies".[8] Another example which used the illustrations without noting any of their major problems was the 1997 textbook by Gerhard and Kirchner.[9]

The embryo illustrations managed to survive the early controversy mostly

> "… because scrutiny never became concerted enough. Among scientists only hostile experts had faulted comparisons that vividly, if approximately, conveyed what many accepted as an established fact. So when the first phases of production and debate ended in the late 1870s, the pictures and the charges still had most of their lives before them. … the embryos gained influence as ever more people saw them, in Haeckel's books and as copies with greater reach. This eventually prepared the ground for the larger contest that followed the rewarming of the accusations for an expanded audience around 1900. Haeckel delivered the *casus belli* by drawing ever more ambitious grids" (p. 143).

Figure 1. Ernst Haeckel's drawing of the primate hierarchy, from an ape, pictured in the lower right hand of the illustration, to a Caucasian, shown in the upper left corner. The most evolved human is actually taken from a statue of a Roman god. (From the frontispiece in Haeckel[16].)

Although his embryo forgeries are most well known,[10] other examples of forgeries exist, all of which were created in an effort to support Darwinism, two of which are noted below. Haeckel was a very talented artist and Hopwood has reprinted scores of his nature illustrations. Especially notable are his drawing of radiolarians, single-celled creatures with elaborate mineral skeletons, which are far smaller than the embryos he 'drew'.[11] His artistic talent argues for the conclusion that he deliberately distorted his embryo and other drawings to support his theory and that the distortions were not due to a lack of talent or due to sloppiness (as has been argued by one defender of Haeckel, Robert Richards in his book *The Tragic Sense of Life: Ernst Haeckel and the Struggle over Evolutionary Thought*, University of Chicago). An excellent critique of Richards is Richard Weikart's review of this book.[12] Furthermore, several other examples of the same behaviour exist. My one complaint, since I own most of Haeckel's original books published in English, is that the colour reproduction is not always as accurate as is ideal.

Hopwood covers not just the life and science of Haeckel but also the history behind his many books and the many controversies that they have caused, not only over his embryo drawings but also on other topics, such as his outspoken racism. All of Haeckel's books had an underlying theme consisting of empirical science, mixed in with anticlerical arguments, Christian myths, and Monist philosophy that taught the material world is all that exists, and that Darwinism explained its existence.

Haeckel's racism

Hopwood covers not only the embryo problem, but Haeckel's blatant white supremacist bias in his books, especially in his grossly distorted illustrations that inferred 'blacks' were significantly closer to the higher apes then were 'whites'. Some of his most infamous racist examples, published first in 1868, show a progression of the highest to the lowest type of humans followed by six examples of apes (p. 86, see figure 1). The lowest human is deliberately drawn to look very similar to the highest ape type.

Indeed, creationists have observed that Haeckel condemned the Bible for its *anti*-racism:

> "All these five [speaking of an earlier classification than Haeckel's own] races of men, according to the Jewish legend of creation, are said to have descended from 'a single pair'—Adam and Eve, and *in accordance* with this *are said to be varieties of one kind or species*. … The excellent paleontologist Quenstedt is right in maintaining that, if Negroes and Caucasians were snails, zoologists would universally agree that they represented two very distinct species, which could never have originated from one pair by gradual divergence [emphasis added]."'[13,14]

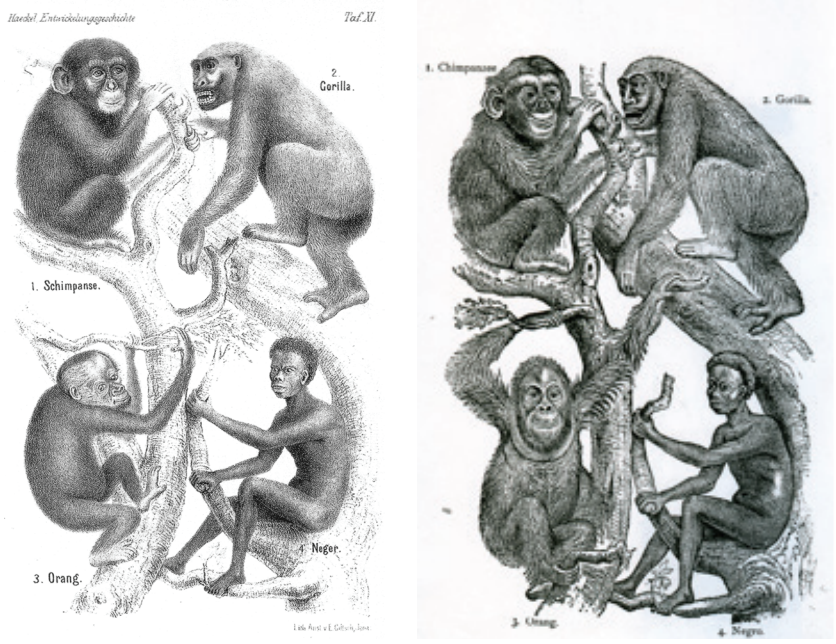


Figure 2. The negro shown in the illustration on the left of the drawing titled Our Family Tree. From Haeckel's 3rd edn of *Anthropogenie*.[17] The earlier edition, shown on the right, from Haeckel's 2nd edn of *Anthropogenie*.[18] As noted in earlier editions, the orang looked far more human in an attempt to show the evolution of humans from apes compared to the revised drawing shown on the right. This is another example of a forgery.

His racism was most pronounced in his two-volume set titled *Anthropogonie oder Entwickelungsgeschichte des Menschen* (1907), "Anthropogenesis or the evolutionary history of Mankind"; English title: *The Evolution of Man*. The fifth edition, published in 1903, showed a human fetus above an ape on the cover, again illustrating the impact of illustrations to convey and convince (p. 148). The fifth edition of this book ran to almost 900 pages, 20 plates, 440 woodcuts and 52 genetic tables (p. 146). The German edition sold 400,000 copies and translations that were completed in 30 languages sold even more copies documenting Haeckel's worldwide influence (p. 148).

Another example is the illustration in figure 2 of three apes and a negro, all pictured on one tree to show their biological relationship (p. 111). His illustrations were also distorted to prove human evolution, so much so that by the third edition of *Anthropogenie* he was pressured to revise the three pictures of apes, especially the orang which looked very human-like in the first two editions (compare the two drawings in figure 2). Yet another example is provided by Joseph Assmuth (1871–1954), Professor of Biology at Xavier College, Bombay, showing that Haeckel drew the feet of apes like those of a man, straightened the back posture and changed the features of the skull to be more human-like.[15] Hopwood even includes copies of some pages from the articles that exposed Haeckel's work, such as the 1997 article in *Science* (p. 287). In short, although Haeckel's

> "… diagrams are profoundly wrong … . Hopwood's excellent, thought-provoking book makes us ponder how these erroneous illustrations acquired their iconic status, and, above all, it shines a spotlight on the power of drawings to influence our thinking."[5]

They illustrate that Haeckel believed the ends justified the means, and the ends include proving both Darwinism and racism. His influence was so great that the university where Haeckel was a professor for most of his career became the centre for the science of racial biology in Nazi Germany (p. 257). Leading Nazi *Rassenhygieniker* ('racial hygienist') and eugenicist, Karl Astel (1989–1945), Rector of the University of Jena where Haeckel taught, even wrote that Haeckel was

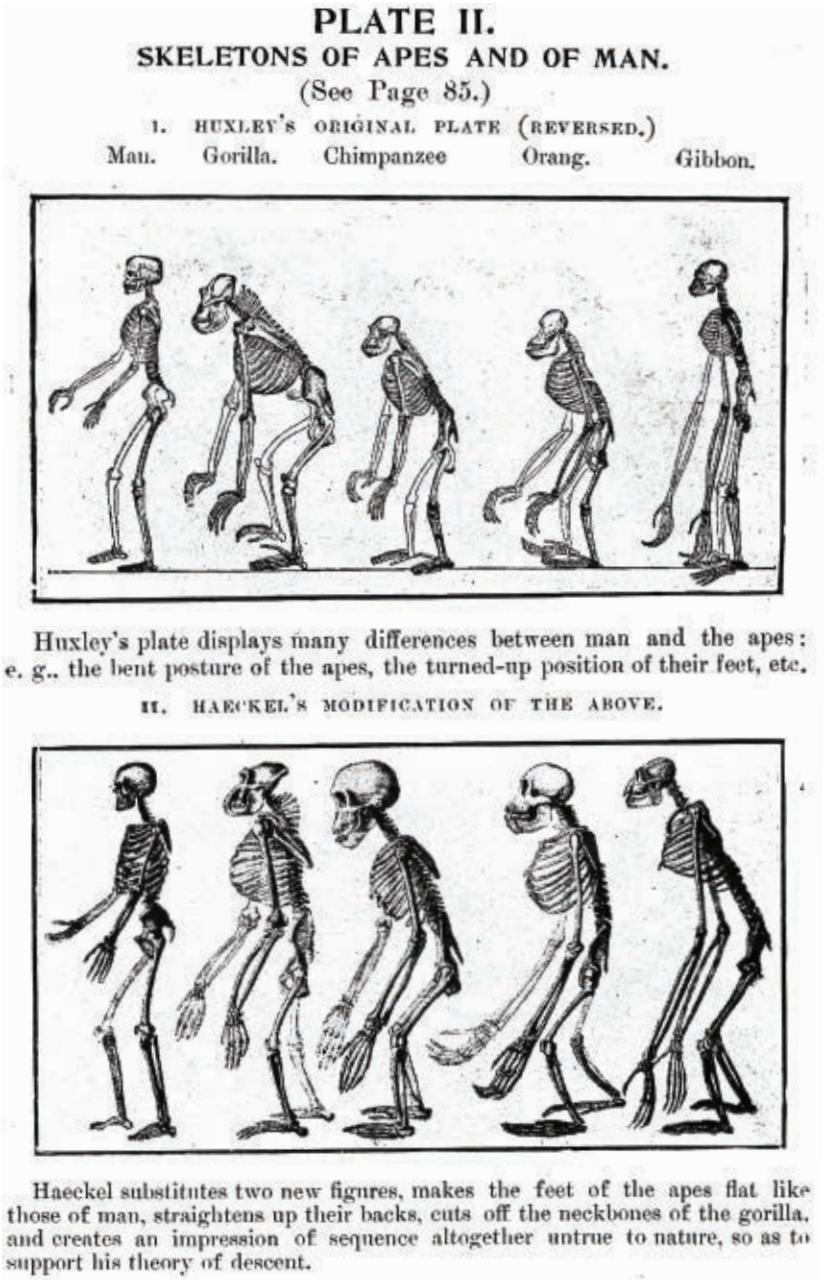


PLATE II.

SKELETONS OF APES AND OF MAN.

(See Page 85.)

I. HUXLEY'S ORIGINAL PLATE (REVERSED.)

Man. Gorilla. Chimpanzee Orang. Gibbon.

Huxley's plate displays many differences between man and the apes: e. g., the bent posture of the apes, the turned-up position of their feet, etc.

II. HAECKEL'S MODIFICATION OF THE ABOVE.

Haeckel substitutes two new figures, makes the feet of the apes flat like those of man, straightens up their backs, cuts off the neckbones of the gorilla, and creates an impression of sequence altogether untrue to nature, so as to support his theory of descent.

Figure. 4 The distortion in the line drawing of apes to a human skeleton set. Note the many differences in the top illustration compared to the redrawn illustration shown at the bottom. The skeletons in the forgery are shown standing more upright, several are taller, and the skulls are far more human, especially the third and fourth drawings from the left. (From the frontispiece in Assmuth and Hull.[15]).

> "'… *one of the most courageous and most significant pioneers of a state concept based on natural law* … and the most brilliant German biologist to date.' The ideas of this 'Aryan scientist' underlay such policies as ridding Germany of Jews [emphasis in original]" (p. 257).

After World War II, communist East Germany's key architect, Walter Ulbrict, "ensured the institutionalization of the Schaxel–Haeckel tradition of free thinking science as a worldview" (p. 257), 'free thinking' referring to atheistic science.

Opposition to Haeckel

Although Haeckel's work and ideas were widely supported in many books by leading biologists, he was not without opposition. For example, "Christian groups invoked Heberer's Göttingen colleague Erich Blechschmidt, who as a human embryologist, … antiabortionist, and antievolutionist attacked Haeckel on all fronts" (p. 259). Even many non-creationists had problems with Haeckel's work, resulting in many people viewing "the German Darwin as a forger" (p. 143).

Haeckel's "Striking designs, provocative rhetoric, and dual audience of scientists and laypeople all courted controversy" for him (p. 143). As a result, Haeckel attempted to avoid using or correcting the more controversial pictures, especially those illustrations that were attacked as forgeries. The ape tree illustrations (figure 2) "were generally criticized only as speculative and dogmatic" and an early apology by Haeckel

> "… might have defused the issue, but Haeckel goaded his critics and then intensified the struggle just as concern mounted over his approach. By 1875 his character was so contested that a host of enemies took even the most honest error as a sign of bad faith. The flawed hero of German Darwinism lived to fight another day, though as a man better at lighting fires than putting them out he never shook the charges off" (p. 143).

Haeckel gave in only in cases where far too many people judged them as grossly inaccurate. Hopwood also reviews the exploitation of Haeckel's forgeries by Darwinism opposers, discussing both the Dover Intelligent Design trial and the Discovery Institute (pp. 293–294) and several creation science organizations that use them (pp. 275–289).

Summary

Only three examples of forgery were noted in this review, but others exist. Haeckel clearly believed that the ends justify the means and continued to distort images in his drawings in an attempt to prove Darwinism. He was spectacularly successful and some of his forgeries lasted for over 100 years. Hopwood has done his homework on this sordid affair and highlighted an embarrassing event in history that many evolutionists wish had never happened. It is a must read for all of those interested in the history of science and evolution. This well-illustrated coffee table-sized book of 388 pages, including 28 pages of notes (pp. 309–337), has carefully documented this history.

References

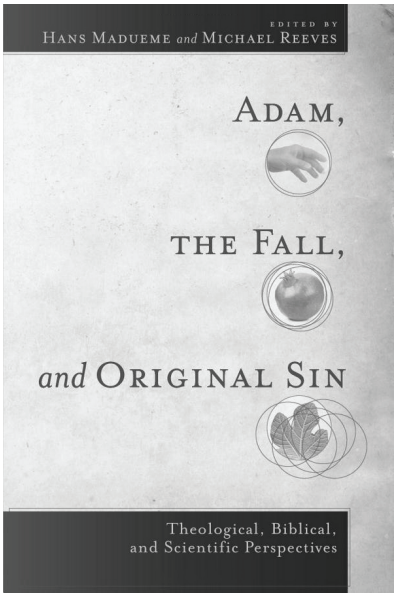
1. In later years, biologists used these drawings to argue that embryos go through a phylotypic stage, where they resemble each other very closely. These textbook writers would typically say that the biogenetic law is not as valid as once thought, but that a phylotypic stage is clearly visible, and that it still supports common ancestry. These authors would typically use Haeckel's embryo drawings, or derivatives thereof, and credit the law to Karl Ernst von Baer. The phylotypic stage idea is also debunked by an earlier paper by Richardson; see: Richardson, M.K., Heterochrony and the phylotypic period, *Developmental Biology* **172**: 412–421, 1995.
2. The second-highest academic rank in the British Commonwealth university system.
3. (Romanes, G.J., *Darwin, and After Darwin—An Exposition of the Darwinian Theory and a Discussion of Post-Darwinian Questions*, Longman's Green and Co., London, 1892)
4. The highest academic rank in the British Commonwealth university system.
5. Cobb, M., Drawn-out lies, *New Scientist* **225**(3004):14, 17 January 2015.
6. Prothero, D., *Bringing Fossils to Life* p. 29, 3rd edn, Columbia University Press, New York, 1997.
7. www.nature.com/nature/journal/v468/n7325/index.html?lang=en.
8. *New Scientist*, 17 January 2015, p. 41.
9. Gerhard, J. and Kirchner, M., *Cells, Embryos and Evolution: Toward a cellular and developmental understanding of phenotypic variation and evolutionary adaptability*, Blackwell Science, Oxford, figures 7–16, p. 329, 1997.
10. See for example van Niekerk, E., Countering revisionism—part 1: Ernst Haeckel, fraud is proven; part 2: Ernst Haeckel and his triple-woodcut print, *J. Creation* **25**(3):89–95, 2011; **27**(1):78–84, 2013.
11. Haeckel, E., *Kunstformen der Natur* (Art forms of nature), 1904.
12. Weikart, R., review of: *The Tragic Sense of Life. Ernst Haeckel and the Struggle over Evolutionary Thought*, *J. History of the Behavioral Sciences* **45**(3):279–299, 2009.
13. Haeckel, E., *The History of Creation [Natürliche Schöpfungsgeschichte], or the development of the earth and its inhabitants by the action of natural causes: A popular exposition of the doctrine of evolution in general, and that of Darwin, Goethe, and Lamarck in particular* pp 412–413, vol II, English edition translated from the 8th German edn by Prof. Ray Lankester, Fellow of Exeter College, Oxford, 1909.
14. van Niekerk, E., Ernst Haeckel: a hostile witness to the truth of the Bible, creation.com/haeckel2, 3 March 2011.
15. Assmuth, J. and Hull, E.R., *Haeckel's Frauds and Forgeries,* figure 3, Examiner Press, Bombay, 1916.
16. Haeckel, E., *Natürliche Schöpfungsgeschichte*, Reimer, Berlin, frontispiece, 1868.
17. Haeckel, E., *Anthropogenie*, 3rd edn, W. Engelmann, Leipzig, 1877.
18. Haeckel, E. *Anthropogenie*, 2nd edn, W. Engelmann, Leipzig, p. 488, 1874.

The vital importance of the historical Adam

Adam, the Fall, and Original Sin: Theological, Biblical, and Scientific Perspectives

Hans Madueme and Michael Reeves (Eds.)

Baker Academic, Grand Rapids, MI, 2014



Lita Cosner

Increasingly, scholars and pastors who otherwise fit neatly within the evangelical spectrum are reinterpreting creation, Adam, and the Fall to fit in with long-age or evolutionary views. However, in *Adam, the Fall, and Original Sin*, 14 contributors from a wide range of specializations in biblical studies, and one anthropologist, come together to present a powerful argument in favour of the historical Adam and Original Sin. The editors are theologians at Covenant College (Georgia) and Wales Evangelical School of Theology, respectively.

Many times, defences of a historical understanding of the first chapters of Genesis are written by people who have dedicated their careers to specializing in creation apologetics—and, many times, these are people with scientific, not biblical studies, specializations. So one advantage of this book is that it is written by people who come from a broader range of backgrounds, as professors, pastors, and Bible translators. As such, they can testify to the importance of biblical creation in their contexts.

Adam and Eve in the Old Testament

It is often claimed that Adam and Eve, while they play a huge role in the first chapters of Genesis, play a small role in the rest of the Hebrew Bible. Scholars also point to parallels in Ancient Near Eastern creation myths to cast doubt on the historicity of Genesis. However, C. John Collins presents the case that Adam and Eve have an enormous explanatory role to play.

First, Genesis is composed as a coherent whole—it is impossible to divorce Genesis 12–50 from its preceding chapters because of the *toledot* structure running through the whole book as well as other grammatical indicators. Thematic elements also tie Genesis together—particularly the theme of being fruitful and multiplying, which even extends into Exodus (1:7 states: "But the people of Israel were *fruitful* and increased greatly; they *multiplied* and grew exceedingly strong, so the land was filled with them [emphasis added].")

Second, even though Adam and Eve do not play a prominent role in the Old Testament after Genesis 4, the consequences of their actions do. "The descendants of Adam and Eve (Gen. 4 and onward) exhibit sad and shameful behavior ... . This cries out for an explanation, and we need some version of the traditional reading of Genesis 3 to make sense of these facts" (p. 21).

Third, references to Adam and Eve are only rare if you define 'reference' in such a way as to exclude any but the most obvious references. There are subtler echoes, where they are suitable to the authors' purpose and could thus be expected, throughout the Old Testament; "there are numerous references to creation (e.g. Pss. 8; 104) and to marriage (e.g. Mal. 2:15, using Gen. 2:24). Human rest on the Israelite Sabbath imitates God's rest after his work of creation (Exod. 20:11, echoing Gen. 2:2–3)" (p. 23).

Collins comes to the conclusion that "The author [of Genesis] was talking about what he thought were actual events, using rhetorical and literary techniques to shape the readers' attitudes toward those events" (p. 31). Sadly, he is not a biblical creationist but seems to embrace an old-earth view. However, his contribution on Adam in the Old Testament in this book is useful for the biblical creationist, nonetheless.

Adam and Eve in the New Testament

Only seven verses in the New Testament explicitly refer to Adam. However, the historical Adam and doctrine of Original Sin plays a much larger role in the New Testament. Robert Yarbrough shows that

> "… paucity of direct reference to Adam is no necessary indicator of his significance. However many times his name is mentioned, he serves centrally in the role in which the Old Testament casts him: the starting point of human existence, flourishing, and sin, with all its attendant woes. And because his sin was met with the seed of

divine saving promise (Gen. 3:15), he is also at the root of human redemptive hope" (p. 41).

Adam and modern science

This chapter is the only one authored by a contributor with scientific, rather than theological, qualifications. He is also the only one to submit under a pen name, "William Stone". The editors say that this is because his position (which is a prestigious one) would be threatened were his colleagues to know his true views. He believes that Adam is historical, but one statement leads us to believe he may be a biblical creationist regarding the timescale of earth history, as well.

Stone weighs evidence for cultural expression, bipedalism, brain size, and more to attempt to place Adam in the fossil record. He places the division between humans and non-humans "at the root of the *Homo erectus*/*ergaster* to *Homo sapiens* lineage around 1.8 million years ago" (p. 78). He argues that the variations within the *Homo* genus are well within the variation we see in other species.

He notes:

"An important problem concerns chronology: did Adam live about 1.8 million years ago, the conventional date for the origin of *Homo erectus*? If so, what does that mean for our reading of the genealogies and the apparently Bronze or Iron Age context of Genesis 4–5? Or do we need to consider a radical revision of the scientific chronological framework?" (p. 81).

This is a question one would expect only a biblical creationist to raise, which might point to this scientist believing not only in the historical Adam, but the biblical chronology.

The most instructive part of Stone's chapter is actually his use of a pseudonym (though his chapter is very well-written, he introduces subjects that would be new to a lot of specialists in the biblical studies field, but not so much to people well-versed in creationist interpretation of the human fossil record). There is at least one anthropologist in a senior position in the field, who nevertheless feels he has to hide his true views. How many William Stones are there in science in various fields, who believe the Bible, and that science supports the Bible, yet must hide their true beliefs to preserve their careers?

Original Sin in patristic theology

Augustine is generally thought to be the first theologian to clearly lay out the doctrine of Original Sin. However, Augustine's own writings vehemently deny that the doctrine originated with him. "It is not I who made up original sin! The catholic faith has believed it from its beginnings. But you who deny it are undoubtedly a new heretic."[1] In fact, many believed it before Augustine: Irenaeus, Gregory, Basil, and Cyprian all referenced it in their writings (p. 88).

Peter Sanlon shows in his chapter that while Augustine developed and systematized the doctrine of Original Sin, particularly in response to the Pelagians, he did not invent it. Furthermore, the doctrine depends on Adam as a historical person whose sin affects all his descendants.

The Lutheran doctrine of Original Sin

Robert Kolb argues that

"Luther simply took for granted that, because Scripture says that all sin is due to Adam and Eve (Rom. 5:12), and also because God does not create or cause evil and so could not be responsible for original sin, children receive this root sin just as they receive body and soul from their parents, through conception and birth. No other possibility fit with his understanding of human existence since the fall" (p. 110).

This is significant, because as a student he had been taught by his instructors that "after the fall of Adam the natural powers of the human being have remained whole and uncorrupted and that each human being possesses by nature sound reason and good will" (p. 110).

Kolb traces the maturation of Luther's thought in this area, and that of his partner and successor, Philip Melanchthon, as well as later influential Lutherans. He points to the "definition of the original sin—at the beginning of human history in Eden and in every individual's daily experience—as doubt of God's Word, denial of his lordship, and destruction of love for him and trust in him" (p. 127). This directly affects how one interprets Jesus' work of salvation.

Original Sin in Reformed theology

Reformed theology affirms that people were created "very good". One distinctive of this system is that it views the relationship between God and man as being defined by covenants from the beginning. Donald MacLeod traces the thought of Calvin, Zwingli, and other Reformed theologians on the Covenant of Works, and how Adam's sin can be imputed to his descendants. Unanimously, Reformed theologians have followed Augustine's doctrine of Original Sin, but also in their belief that this Original Sin could not be the Creator's responsibility.

Original Sin in Wesleyan theology

Thomas McCall covers the doctrine of Original Sin in Wesleyan theology. John Wesley "was convinced of the universality and power of sin"

(p. 148). In fact, Wesley even affirms that, because Adam was a "public person"—to use the wording of the Westminster catechism—Adam represented his descendants when he sinned (p. 149). Christ was similarly a representative, in his obedience, of those who believe in Him. Wesley's primary contribution was that, because of his belief in prevenient grace, he used that parallel to support universal atonement.

Wesley's successors insisted that Adam was a historical person, and that his fall was a historical event. Their doctrine of Original Sin led them to reject Pelagianism, semi-Pelagianism, and Socinianism with respect to hamartiology. However, by the latter 19th century, Methodist theologians were beginning to shift in their understanding, emphasizing the freedom of the will. "A predominately *theological* emphasis on holy love was traded for a predominately *anthropological* emphasis on freedom of the will" (p. 165).

Original Sin and modern theology

Carl Trueman takes on the treatment of the doctrine of Original Sin in modern theology, and how it has largely been ignored by liberal theologians. Trueman chooses six theologians who have jettisoned a belief in the historical Adam and Eve and Original Sin, and shows what happens to one's overall theology when this foundational doctrine is rejected. He gives a brief summary of the beliefs of Friedrich Schleiermacher, Walter Rauschenbusch, Karl Barth, Rudolph Bultmann, Reinhold Niebuhr, and Wolfhart Pannenberg. He notes similarities in their theology:

> "First, all of them repudiate any notion that humanity stands guilty before God because of the imputation of an alien guilt, the guilt of a historical man called Adam, to all of his descendants. ... Second, all of the theologians reject the relevance of the historicity of Adam" (p. 184).

This has disastrous consequences for the theology of all of the surveyed theologians, and serves as somewhat of a cautionary tale for those who would compromise in this critical area.

Original Sin in biblical theology

James Hamilton examines Original Sin through the lens of biblical theology. He notes that the Torah teaches an originally 'very good' world, marred by Adam's sin. And the consequences of Adam's sin are shown in the narratives immediately following Genesis 3:

> "… when Cain murders Abel, the reader knows that in Adam's sin the dam was breached, burst, and the water can never be put back. The flood of sin has rushed out, leaving death in its wake (Gen. 4); then the genealogy in Genesis 5 repeats again and again the awful refrain, 'and he died'" (p. 192).

In other words, Adam's sin is the explanation for all the sin and death we see reigning throughout Genesis and the rest of the Torah. Likewise, the rest

Figure 1. Denying a historical Adam creates massive theological problems across a range of disciplines.

of the Old Testament does not spell out *why* humans are sinful—because Genesis has already done that—but they *assume* humans are sinful.

The New Testament "assumes Adam was a historical person whose initial transgression had devastating consequences for all his descendants" (p. 206), which is especially clear in the writings of Paul. Furthermore, Revelation presents the defeat of the serpent, the ultimate triumph of Christ, and the restoration of creation to be even better than Eden was. Hamilton concludes: "Followers of Jesus will follow him in his understanding of the world's origins, the world's problems, and the resolution to the sin of Adam in the obedience of Jesus even unto death" (p. 208).

Original Sin in systematic theology

In their chapter, Michael Reeves and Hans Madueme show that the denial of a historical Adam and Original Sin entails significant "theological fallout" (p. 210). First, the belief in the historical sin and fall of Adam is necessary because otherwise evil, rather than a very good creation (which later became corrupted), was its original state. The idea that we all inherited Adam's sin in some sense is necessary, because it means that all humans have the same problem—and that Jesus is equally the Saviour of all people. In fact, "The doctrine of original sin directly affects what it means to say that Jesus is Savior" (p. 223). If the Fall was not a historical event that corrupted the human race, Jesus becomes more like an example or a teacher, not a Saviour in the sense of reversing the Curse.

Original Sin and modern science

Hans Madueme shows that theistic evolution rejects a historical Fall of mankind, and thus must introduce other mechanisms to "fill the void" (p. 230). Some use nature and nurture, others use human freedom, and still others point to entropy to explain sin. However, without a historical Fall, God is in some sense the author of evil, which is a huge theological problem.

Others retain a historical Adam; some old-earth creationists retain a special creation of Adam, and view earlier hominids as non-human pre-Adamites. An evolutionary view says that Adam was actually descended from these pre-Adamites. A federal headship view has a group of humans evolving together with Adam as the federal head of his *contemporaries* as well as his descendants. However, there is a problem with the timescale—'Adam' is moved farther and farther back to conform with new anthropological discoveries, thus undermining the biblical genealogies. All attempts to make the biblical account fit with the evolutionary view end up undermining inerrancy.

Madueme proposes first that evangelicals should affirm biblical inerrancy, meaning that as the Word of God, Scripture is true in all that it affirms. Second, he encourages evangelicals to embrace what he terms 'pneumatic certainty', meaning the testimony of the Holy Spirit to the Christian that Scripture is true. Third, he proposes an eclectic approach to scientific theories, leaving the Christian free to affirm scientific theories that do not conflict with the teaching of Scripture, while rejecting those that do.

Original Sin in Pastoral Theology

Daniel Doriani shows that the widespread rejection of the doctrine of Original Sin poses substantial challenges for pastors. Most people today believe that man is essentially good. 'Evil' is a category reserved for people like Hitler and Stalin—most people are either seen as ignorant, short-sighted, mentally ill; ultimately victims, not sinners. This failure to accurately identify the problem leads to 'solutions' that encourage people to be better, without pointing them to Christ, or pointing them to Christ as an afterthought. Doriani says that pastors especially have to understand the doctrine of Original Sin, and its effects on themselves and their church in order to lead effectively: "a robust doctrine of sin is central to gospel preaching and discipleship because it insists that we place our hope, our trust, in Jesus alone" (p. 268).

Original Sin and original death

Thomas Schreiner gives a detailed exegesis of Romans 5:12–19, which shows that people die because of both personal sin and Adam's sin.

> "Adam's typological and foundational role, however, is emphasized. Sin and death came into the world through him, and personal and individual sin find their roots in Adam's sin. All human beings are sinners, dead, and condemned before God because of Adam's one sin" (p. 287).

He interacts with other views and shows how they do not do justice to Paul's statements in this passage.

The Fall and Genesis 3

Noel Weeks, theologian and scholar of ancient history, shows how a denial of Adam leads to attempts to explain Genesis 3 as a reconfiguration of other ancient texts. He surveys the most common candidates and shows how they all fall short. Next, he examines what many see as a key conundrum in Genesis 3: though death is threatened as the consequence for eating from the Tree of the Knowledge of Good and Evil, Adam and Eve do not die that day; Adam lives to be 930 years old. Weeks gives the interpretation of "dying you shall die" that is

the common biblical creationist understanding of the passage. Weeks examines the serpent's temptation, Adam and Eve's roles in the Fall, and God's judgments on the serpent, Eve, and Adam.

Adam, history, and theodicy

One of the questions often asked of apologists is: "If God is all-good and all-powerful, how can there be evil in the world?" In the final chapter, William Edgar shows how the account of Creation and the Fall answers that question, but only if it is taken as historical. Any approach that attempts to explain the account in an evolutionary scenario falls short.

A useful work

While there are some arguments presented in this book that the informed creationist will already know, there are many arguments from theology and church history which will likely be new. Many of the contributors to this volume are not biblical creationists. However, timescale is not the focus of this book and the compromising views of the old-earth authors do not come through for the most part. This is a book that creationists can read profitably. I was personally encouraged and informed by many of the chapters.

References

1. Augustine, *Marriage and Desire* 2.12.25, cited on p. 86.

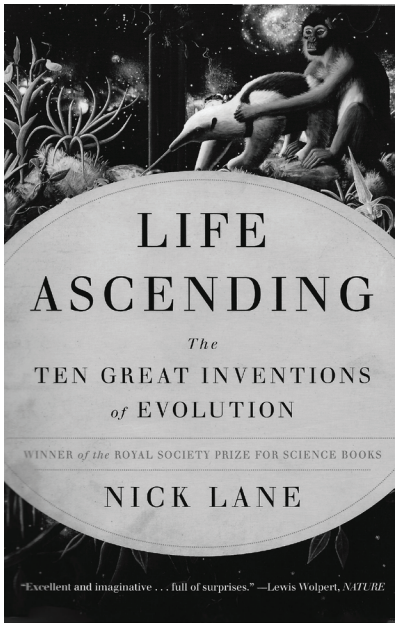
Evolutionary speculations, yet no 'badly designed' vertebrate eye

Life Ascending: The Ten Great Inventions of Evolution

Nick Lane

W.W. Norton & Company, New York, 2009

John Woodmorappe



Author Nick Lane is a biochemist. He is identified as the first Provost's Venture Research Fellow at University College London.

The author comes across as a run-of-the-mill neo-Darwinian evolutionist. He generally thinks that evolution occurs step-by-step and endorses the selfish gene concept of Richard Dawkins (p. 295).

This book is primarily a biology book. Most of the time, it simply assumes evolution as an outcome of all living objects and biological processes, and does not attempt to demonstrate evolution itself. This book raises topics as diverse as abiogenesis, the DNA molecule, unicellular to multicellular life, the comparative biology of vision in animals, ectothermy and endothermy, human consciousness, the biology of ageing, and more.

Rejection of God in practice

Unlike many evolutionists who are openly atheistic, Lane leaves it an open matter whether or not belief in God, and acceptance of organic evolution, are compatible (p. 287). He also professes a desire to avoid offending the sincerely held religious beliefs of people (p. 232).

What about God 'using' evolution for His creative purposes? Upon hearing the word inventions, as in the title, one intuitively thinks of an inventor. Author Nick Lane quickly disabuses the reader of this. In fact, he rejects all teleological notions in favour of old-fashioned selectionism. Thus, he falls back on Dawkins' 'blind watchmaker' notion, in that unintelligent naturalistic processes are imagined to have virtually unlimited potential for creating exquisite designs of living things. He comments:

> "I must clarify what I mean by invention, for I don't want to imply a deliberate inventor … . Evolution has no foresight, and does not plan for the future. There is no inventor, no intelligent design. Nonetheless, natural selection subjects all traits to the most exacting tests, and the best design wins out … . Design is all

around us, the product of blind but ingenious processes" (p. 2).

Clearly, the author has no use for so-called theistic evolution. Furthermore, he rejects what he calls "adding a little God" as a solution to difficulties in evolutionary theory (p. 89).

What about God and evolution as 'separate magisteria'? Pope John Paul II had freely accepted evolution but also had asserted that the human mind is beyond science. Lane rejects this dualistic thinking and supports the understanding of the human mind in terms of science (pp. 232 ff.). He also thinks that humans have a hard time thinking of their cognitive and emotional experiences as neuronal ones for the simple reason that the brain has no pain receptors and so is not aware of its own activities.

A survey of origin-of-life hypotheses

The author begins with the classic Urey–Miller experiment of 1953. He stresses the difficulty of obtaining sufficient concentrations of reagents in the prebiotic atmosphere, as well as the fact that it is no longer believed that the earth ever had a Jupiter-like 'reducing' atmosphere (rich in hydrogen compounds).

Lane then discusses deep-ocean vents. They produce a variety of compounds, and heat. This has led to a number of scenarios on the origin of life, which the author discusses. He is, however, candid about the almost-insurmountable problems that the vent hypotheses immediately encounter. One of these is the obtaining of sufficient concentrations of organic molecules, notwithstanding the template effects of iron pyrites (p. 18). In addition:

> "Other problems include the temperature (some say too hot for organic molecules to survive), the acidity (most black smokers are too acid to support the chemistry that Wächtershäuser proposes, and his own lab synthesis only worked in alkaline conditions), and sulphur (too much, relative to modern biochemistry)" (p. 288).

Lane then 'pulls a fast one' on the reader. He credits the Krebs cycle (see figure 1) as one of the first major features of ancient life, based on its ubiquity among living things, the fact that it can work in reverse, and the fact that the cycle will 'spin' on its own if the concentrations of its chemical constituents are sufficient (p. 26). Owing to the latter, Lane suggests that genes were a later evolutionary add-on, in that they started to modulate the Krebs cycle, but not run it, just like the conductor of an orchestra modulates the music but does not make the music itself. However, in saying all this, Lane glosses over how this already-complex cycle is supposed to have spontaneously developed—or somehow been able to reproduce itself without genes! In addition, there is admittedly no clear-cut boundary between 'primordial' and 'add-on' biochemical processes: "How much of the core mechanism of life on earth arises spontaneously, and how much is a later product of genes and proteins is an interesting question, and one that is beyond the scope of a book like this" (p. 26).

Baselessness of all evolutionistic origin-of-life hypotheses

The author finds the age-old "given enough time and enough attempts, anything can happen" thinking, in his own words, unsatisfying (p. 9). However, he does not tell the reader why he finds it unsatisfying. The problem, of course, is that it is an all-purpose explanation that is really a non-explanation. For example, an astronaut could find a 500-word English-language glyphic on the moon (with fully sensible letters, syntax, grammar, and paragraphs), and someone could say that an unusual but natural chemical-etching process made that. After all, given a virtually unlimited number of planetary bodies in the universe and billions of years of chemical-etching events on these innumerable planetary

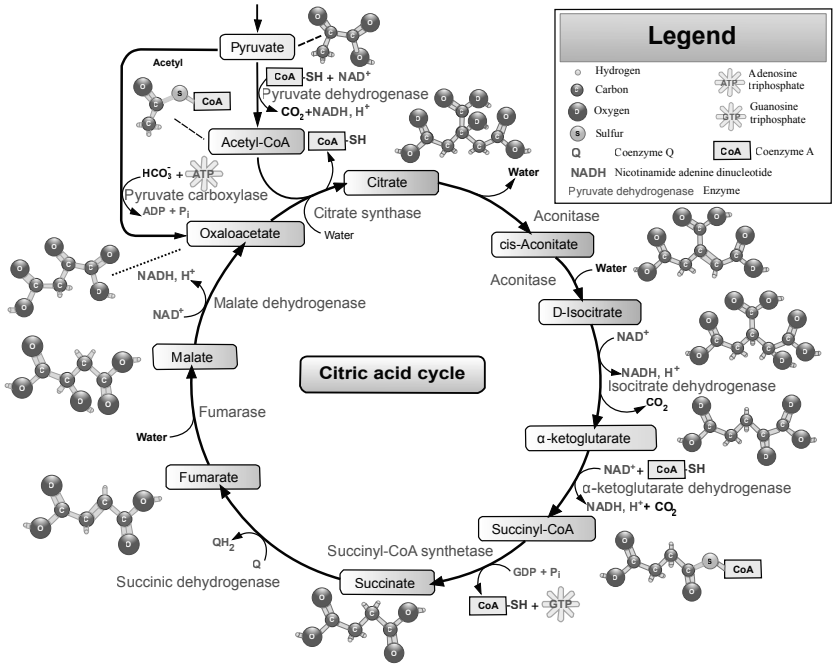


Figure 1. The Krebs, or citric-acid cycle. Though allegedly a stand-alone biochemical process in the early evolution of life, it is already quite complex.

bodies, anything could have happened. *Somewhere* it happened, so why not on our moon? Had it not happened on the moon, no one would be asking anything about it.

The author then brings up Fred Hoyle and Francis Crick and their directed panspermia hypothesis. Lane rejects this, because it assumes that science cannot explain the origin of life. However, the issue is more fundamental. Directed panspermia does not solve the problem: It merely relocates the problem. If life arose on another planet, then how did it originate on *that* planet?

Although Lane finds promise in the deep-ocean vents in the origin of life, he finally admits that the production of various molecules, which is observed there, does not account for the presumed abiotic origin of life. Instead, all he can do is engage in wishful thinking and the *assumption* that evolution took place, as he writes:

> "That is all very well, but a single reactor, however valuable, scarcely constitutes life. How did life progress from such natural reactors to the complex, marvelous tapestry of invention and ingenuity that we see around us? The answer, of course, is unknown, but there are clues that derive from life itself, and in particular from an inner core of deeply conserved reactions common to almost all life on earth today" (p. 23).

He is referring to the Krebs cycle which, as noted earlier, itself raises the question about the *origin* of the Krebs cycle.

In the end, Lane tacitly admits the inadequacy of all abiotic origin-of-life scenarios as he resorts to an *ad hoc* postulated long history of abiotic evolution. In doing so, he falls back on the 'natural selection acting on mutations can do anything and everything' magical thinking. These rationalizations encompass the newer theories that focus on the deep-sea vents. He comments:

> "Of course, a natural proton gradient is only of use if life is able to harness the gradient, and later on generate its own gradient. While it's certainly easier to harness a pre-existing gradient than it is to generate something from scratch, neither is straightforward. These mechanisms evolved by natural selection, there is no doubt … . Life could not leave the vents until it had learnt how to harness its own chemiosmotic gradient, but it could only harness its own gradient using genes and DNA. It seems inescapable: Life must have evolved a surprising degree of sophistication in its rocky hatchery" (p. 33).

And it lived happily ever after. However, natural selection requires self-reproducing life to pass on any benefits selected, so can't explain self-reproducing life in the first place.

Further proof of a giant chasm between prebiotic molecules, and the simplest forms of life, comes from Lane's discussion of the amoeba and related 'simple' animals. The author admits that, while simpler than 'higher' forms of life, they are much more complex than the postulated earlier forms of life that had supposedly descended from the common ancestor of all living things (p. 90).

Implicit evidence against serial endosymbiosis

According to serial endosymbiosis, certain organelles, notably the mitochondria and the chloroplasts, were once small, stand-alone cells. These once stand-alone cells entered into a symbiotic relationship with larger cells and then became engulfed by these larger cells. The symbiotic relationship continued, but now as organelles that dwell within the larger cells.

The author is rather dogmatic about serial endosymbiosis, even stating: "There's no dispute now that mitochrondria were once free-living bacteria" (p. 140). However, he admits that how this supposedly happened is little more than *ad hoc* speculation: "It's possible that the eukaryotic line evolved into a primitive phagocyte before engulfing the mitochondria, but there's not a shred of genetic evidence to support this conjecture" (p. 107).

But it must have happened—or did it? One of the chief lines of evidence in favour of endosymbiosis is the existence of DNA within the mitochondrion. To begin with, mitochondrial DNA is not even vestigial. Nor, as we shall soon see, is mitochondrial DNA redundant with that DNA that is located in its 'proper' place—the nucleus.

Serial endosymbiosis assumes that extra-nuclear DNA necessarily implies the 'government' of a once free-living cell. Ironically, Nick Lane admits that counter-intuitively this is not so, at least not necessarily:

> "Mitochondria are a silly place to store genes … . [However] Even when functioning normally, respiration has to be continuously fine-tuned by 'fiddling with the knobs', adjusting power to demand … . Just as an army's tactical disposition on the ground shouldn't be controlled by a remote central government, so the nucleus is not well placed to tune up or down the many hundreds of individual mitochrondia in a cell. Mitochondria, then, retain a small genome to tune respiration, matching power to demand" (p. 110).

Obviously, genes within the mitochondria are not so silly after all. The DNA within the mitochondrion serves a function that is essential to proper mitochondrial function in its existing state. There is no warrant for thinking of it as some kind of evolutionary

leftover from when the mitochondrion had supposedly been a stand-alone cell.

Prokaryotes and eukaryotes—the evolutionary tree collapses

Lane points out another chasm—that between bacteria and other forms of life. He comments:

> "Today the gap between plants and animals is perceived as quite narrow, while a dreadful gulf has opened up between bacteria and all the rest of complex life. It is the crossing of this gulf that causes so much disagreement among scientists: How exactly did life go from the primitive simplicity of bacteria to the complexity of plants and animals? Was it always likely to happen, or shatteringly improbable? Would it happen elsewhere in the universe, or are we more or less alone?" (p. 89).

The author attempts to resolve questions about the timing of the evolution of unicellular life-forms through the use of 'molecular clocks'. However, he admits that this leads to impossible results, which can only be resolved by including *ad hoc* beliefs in either the immutability or mutability of various 'molecular clocks' (p. 99).

Lane supports the division of all life into three great domains: bacteria, archaea, and eukaryota. However, any 'evolutionary tree' of these domains is completely confounded by alleged ancient gene-transfer and gene-fusion events. The author describes this unhappy situation in evolutionary thinking—one which furthermore only intensifies with additional research—as follows:

> "If we choose only genes shared by all three domains of life (those found in bacteria, archaea and eukaryotes), we can recommend robust trees for bacteria and archaea, but not eukaryotes. The eukaryotes are a confusing mix. Some of our genes apparently derive from archaea, others from bacteria. The more genes we study—the one recent analysis combined 5,700 genes, drawn from 165 species into a 'supertree'—the more plain it becomes that the eukaryotic cell did not evolve in a standard 'Darwinian' way, but rather by some sort of mammoth gene fusion. From a genetic point of view, the first eukaryote was a chimera—half archaea, half bacteria" (p. 102).

Perhaps it did not evolve at all.

Dysteleology of the 'backward-layered' human retina debunked

The author recounts the apparent inferiority of the human eye relative to the octopus eye:

> "A common argument has it that the design flaws run very deep and are in fact good evidence of the way in which evolution has cobbled together inept unplanned structures, crippled by its own lack of foresight…our own retina is often said to be plugged in backwards, an apparently idiotic arrangement. Rather than jutting out, the light-sensitive cells sit at the very back, covered by neuronal wires that pass forwards on a roundabout route to the brain. Light must pass through this forest of wires before it can reach the light-sensitive cells; and worse still, the wires form a bundle that plunges back through the retina as the optic nerve, leaving a blind spot at that point" (p. 174). (See figure 2.)

Lane then parts ways with most evolutionists, who insist that the 'backward retina' is 'bad design'. He elaborates on the non-liability, and then the advantages, of the 'backwards' human retina:

> "The wires are colourless, and so don't hinder the passage of light much; and insofar as they do, they may even act as a 'waveguide', directing light vertically on to the light-sensitive cells, making the best use of available photons. And probably more importantly, we have the advantage that our own light-sensitive cells are embedded directly in their support cells (the retinal pigment epithelium) with an excellent blood supply immediately underneath. Such an arrangement supports the continuous turnover of photosensitive pigments. The human retina consumes even more oxygen than the brain, per gram, making it the most energetic organ in the body, so this arrangement is extremely valuable. In all probabthe

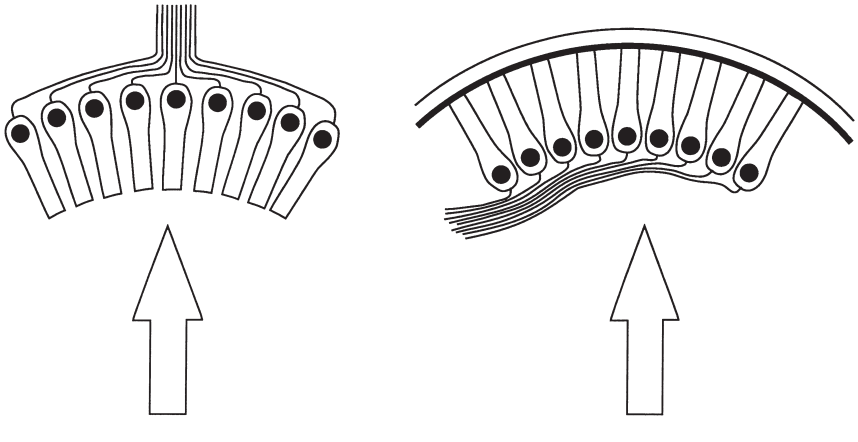


Figure 2. The 'backwards' human retina. The author is one of the few evolutionists who rejects the notion that this is 'bad design'.

> octopus eye could not sustain such a high metabolic rate. But perhaps it does not need to. Living underwater, with lower light intensity, the octopus may not need to re-cycle its pigments so quickly" (p. 175).

The foregoing chain of reasoning can be generalized. In fact, Lane exposes the flawed reasoning of *all* dysteleological arguments. This is so even within the non-theistic constraints of evolutionary reasoning. The author quips:

> "This glib assertion overlooks the mischievous rule known as the second law of Leslie Orgel: Evolution is cleverer than you are. … My point is that there are advantages and disadvantages to every arrangement in biology, and the outcome is a balance of selective forces that we don't always appreciate. This is the trouble with 'just-so' stories: all too often we see only half the picture. Arguments too conceptual in nature are always vulnerable to counterblasts" (pp. 174–175).

Of course, it is not evolution that is clever. Rather, it is God who is infinitely cleverer than all His critics.

Endothermy and ectothermy

The author discusses the comparative biology of 'cold-bloodedness' and 'warm-bloodedness' and elaborates on the decades-long debate on the thermal physiology of the dinosaurs. Ectotherms have the advantage of requiring a low food supply and of being better adapted for life in the hot desert. On the other hand, the endotherms have the advantage of being able to perform sustained actions.

The reader can think of the battle between the mongoose (an endotherm) and the snake (an ectotherm). The snake can deliver rapid bites but cannot keep repeating this action in succession. The mongoose can sustain action, repeatedly provoking the snake to strike, and then jumping out of the way. The snake becomes fatigued much sooner than the mongoose and the mongoose then turns on and kills the exhausted snake.

The limited ability of lizards to engage in sustained action is discussed by Lane (p. 210). However, this has been known since biblical times. The lizard can be caught with the hands (Proverbs 30:28) because it can readily be chased to exhaustion.

Against neurobiological reductionism of the human 'self'

The author appears to advocate, but soft-pedal, the notion that the human 'self', and human consciousness, are nothing more than the products of neurobiological processes. According to conventional evolutionary thinking, human consciousness is supposed to be a recent development in evolution and one that is a product of the 'higher' centres of the human brain.

However, the author presents intriguing evidence that this is not so. He discusses children with hydranencephaly, where most of the cranium is filled with cerebrospinal fluid and virtually all the cerebral cortices are missing (p. 257). He comments:

> "One remarkable suggestion that consciousness is more widespread than we like to credit is the survival and apparent consciousness of those few exceptional children who are born without cerebral cortices … but according to the Swedish neuroscientist Björn Merker, despite the absence of nearly all the brain regions that we normally associate with consciousness, some of these children are capable of emotional behavior, laughing and crying appropriately, and showing signs of genuinely human expression" (p. 258).

There is, of course, an unmentioned alternative to the notion that consciousness is widespread in the animal kingdom and located in the "lower" rather than the "higher" brain centres. Perhaps the human "self" is not solely reducible to neurobiological processes in the first place!

Conclusions

Despite much recent publicity about deep-ocean vents as the source of the origin of life, the evolutionistic origin-of-life hypotheses remain entirely conjectural.

The evolutionary 'tree' is an abject failure when it comes to resolving the relationships between the three main 'branches' of life: the bacteria, archaea, and eukaryotes.

The DNA found in the mitochrondrion appears to be functional, playing a role in the fine-tuning of mitochrondrial energy production. No evolutionary endosymbiosis is necessary to account for this mitochondrial DNA.

The author of this book is one of the few evolutionists who repudiates the 'bad design' argument for the 'backwards' human retina. The deployment of blood vessels in front of the photoreceptor cells does not hinder vision and turns out to be essential for the delivery of an adequate blood supply to the high-performing human retina.

Creationism, evangelism and that bothersome debate?

Christians and Evolution: Christian Scholars Change Their Minds

R.J. Berry (Ed.)

Monarch Books, Oxford, UK, 2014

John D. Matthews

Professor R.J. (Sam) Berry has been involved in the creation-evolution debate for over 30 years. He is Emeritus Professor of Genetics in University College, London, a Reader in the Church of England, and a member of its General Synod.

In a written debate published by InterVarsity Press, Leicester, UK, 30 years before the present book was published, Berry made two comments.[1] First,

> "... the continuing controversy [*between creation by fiat and evolution*] has undoubtedly been a stumbling block in evangelism since many who are not Christians regard the wrangling as a sign that Christians are out of touch with reality, and that the Christian God is irrelevant to ... everyday life" (p. 76).

Second, "I am bored and increasingly irritated by the 'creation debate'" (p. 107).

In response, his debating partner on 'The Origin of Life' part of the publication, the late Professor Verna Wright said that though Berry

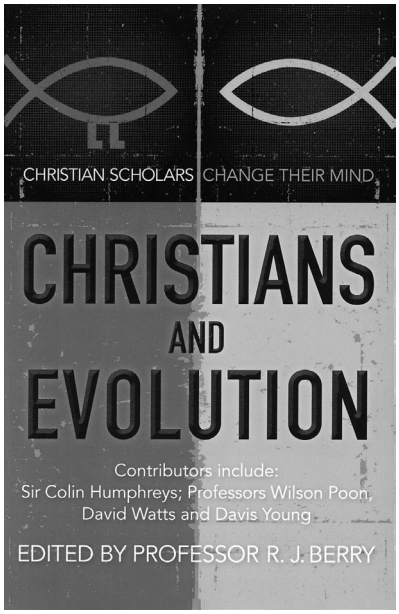
> "... confesses to be bored and irritated, ... That is unfortunate because the debate is here to stay! Neither can the matter be swept under the carpet by [*Berry's*] claim that Darwin brought God back into this world [*since Huxley and others*] state clearly that [*Darwinism*] ... eliminated the idea of God from rational discussion" (p. 109).

We are therefore left wondering why Berry continues to be involved with the creation debate. He has been a major contributor to articles and book reviews on this subject in the journal of Christians in Science (CiS), namely 'Science and Christian Belief' in the intermediate years. You don't dampen down a debate by continuing it. And his studious avoidance of mainstream creationist articles and high-profile debates is also disappointing.

The book

Now, just as Berry's book cannot be construed as a personal *(ad hominem)* attack on any particular creationist, this review is not an *ad hominem* attack on him or any of his contributors. For the simple expedient of making it easier for the readers, references to Berry *et al.*, whilst they discuss the details they have written, must be seen as a comment on the positions they have taken and not they themselves.

The first 27 pages are taken up by Berry's introduction. There are then 18 contributions in the form of 'life-testimonies' from different people covering the next 304 pages. Then there is a brief epilogue. Next there is a reading list called 'Going Further' which contains no useful references to recent creationist material or organisations, though it does refer to certain atheistic publications promoting evolution and individual books by some of the contributors. These will be mentioned below where appropriate. Finally there is an index.



The 18 individual contributions largely follow the theme of how those individuals have made peace with 'mainstream science' and still accept that Genesis contains important theological truths relevant to a godly life. Of the 18, five have always believed in evolution from their formative years and in four contributions we are not told whether they were ever creationists and then changed their minds. To that extent, the subtitle of the book (*Christian scholars change their minds*) is imprecise. One contributor may have been a supporter of Intelligent Design before accepting Darwinian evolution. In the other eight contributions we hear about how the individuals were influenced positively in their earlier years by creationist books, speakers, and literature, but later found problems emerging with that viewpoint from 'mainstream science', so they became evolutionists.

Berry's editorial remarks

In his two-page foreword, Berry shows his dominant theme to be concerned with maintaining respectability amongst Christians with

'mainstream science and evolution'. His words are: "We must be able to interpret and expound the Bible in ways which are consistent not only with itself but also with God's other book, his book of works—which is creation, the study book of science." This might have been an acceptable way to begin the book for all Christians if Berry had said that the science he is considering must not be constrained by naturalism. He did not, though a contributor to the book (David Watts) did digress on the matter briefly.

In the introduction, he states that "fossils demonstrate that the earth goes through major changes and long ages". (Note the plural 'changes'.) Having accepted 'deep time', he then scours the theologians for support that long ages can be read into Genesis. His first support is from Wenham[2] who describes Genesis as 'paradigmatic and proto-historical'. Further support comes from Kevan[3] and Kline.[4] There is no reference to McDowell,[5] an older but still very relevant apologetics book, other creationist theologians, or even to liberal theologians such as Barr.[6] The latter has pointed out the inconsistencies with trying to pretend that the Bible is the Word of God and yet dismissing major portions of Genesis where it is obvious that the writer intended that the reader accept the writer's view that it was history being described. Barr, although a liberal theologian, is at least consistent with his attitude to the Bible.

In the process of justifying how we might be able to explore the science of creation, Berry repeats some of his own material from that 1985 debate. In particular, he attempts to show that God does use natural process to achieve his aims. His example is that of the West wind used by God to part the Red Sea so that the Israelites could cross away from Egypt. He accepts that the West wind was unusual. So while there is a physical connection between an unusual wind pattern and its subsequent effect on the sea, which possibly could have been explored if we had had more data, we can never explore by science how matter (protons, electrons, etc) appeared at the beginning of time. That is beyond science—what we might call a 'bara' event, creation *ex nihilo*. Evolution, the biological development of man from molecules is not normally detached in mainstream science from the big bang, galaxy formation, etc. Berry steers away from these further debatable subjects as if they don't matter in assessing whether Genesis is describing real history. His focus is on a small part of the total God-driven process of 'starting with nothing and arriving at nature', namely the last bit—'molecules to man'. (Note however that Humphreys' and Godfrey's contributions mention the issue.)

Berry then jumps straight into Darwin's writing, without realizing that Darwin admitted[7] in 1844 that, "I always feel as if my books came half out of Lyell's brain." The point about this is that Lyell, the lawyer, had a very strict anti-biblical agenda.[8] Any suggestion that Moses had anything useful to say about the world had to be avoided just as a defence lawyer in a court totally avoids helping the prosecution. Therefore, to pretend that Darwin didn't have this same mindset is disingenuous in spite of Berry's later protestations.

At this point, Berry asks why Darwinism has not been universally accepted by Christians. He gives the following six reasons with brief comments which would provide focus for debate if Berry and his contributors are ready for face-to-face encounter:

First, is to ask where the essential variations necessary in evolutionary theory come from. This was a problem that Darwin expressed. Berry believes that the neo-Darwinian synthesis provides the explanation. But even within mainstream science this is not universally accepted, but the search goes on for an explanation for something that creationists believe cannot be answered by naturalistic science.

Second, is the problem of explaining the Fall. Berry has made attempts to explain this in his CiS articles[9] but has been challenged on his theology by other members of CiS who are not creationists.[10]

Third, evolution is random. Berry removes this problem from his list by referring to Conway-Morris's work[11] on 'convergence'. But Conway-Morris's many studies rely on the robustness of the geological column and that, as the present author[12] and many others have shown, is nothing other than a correlation with wide margins of error. To that extent, it is not fit for this purpose of assessing a unique fossil order.

Fourth, God is not involved in evolution—a comment that is often made by ardent atheists. Berry's comment is more concerned with his personal rejection of Intelligent Design rather than addressing the objection. So like the preceding reasons 1–3, there are still answers needed from Christian evolutionists.

Fifth, there are sociological issues. Berry admits that the fact that Hitler, Marx and others have been supporters of Darwinian evolution—and their pronouncements and appeal to Darwinism to justify their beliefs and actions—will remain a problem for such Christians.

Sixth, science is limited. But how many dogmatic atheists will even think about this issue and are willing to admit it?

The testimonies

We deal with those nine contributors whose testimony indicates that they were once creationists, but are now evolutionists.

Colin Humphreys

Humphreys was exposed to creationism through his parents. In his school biology lessons he was allowed to ask fundamental questions and on occasions found that the teacher could not answer the objections he then had over evolution. In college, where he did engage with biology, there were no discussions of alternatives. His final challenge to leave creationism came with his realization that radiometric dating told of an old earth. He now accepts the standard scientific view of the big bang (which Berry studiously avoids), the formation of the earth, molecules and then man.

Karl Giberson

Giberson is a physicist who encountered Whitcomb and Morris's *The Genesis Flood*[13] before his college days. However, his college professor suggested that Genesis is poetry but having met Morris and Gish, he remained a creationist. But to quote, "... as I studied, ... I began to realize that science could not possibly have got everything so thoroughly wrong as creationists suggested." Alongside that feeling, since so few scientists accepted the thesis of *The Genesis Flood*, he then rejected creationism. We have seen this point made by theologians concerning *The Genesis Flood* in earlier years, for example Kidner.[14] And from personal experience, putting the same point to Wenham in his lecture course produced the same response. Such evolution-supporting Christians are looking for atheists to flock to creationism before the anti-creationist theology will change even from evangelicals. But the reason for scientists rejecting *The Genesis Flood* is the deliberate bias within those scientists[8] who don't want God around.

One of Giberson's own books from 2008 is referred to in Berry's 'Going Further' list. There seems to be a fair amount of common material between that book and this chapter in Berry. The fact that Bergman[15] had reviewed Giberson's book in 2011 gave Giberson an opportunity to address the points raised by Bergman, but this did not happen. The debate isn't getting to the bottom line because of reluctance by evolutionists to engage.

Stephen Godfrey

Godfrey is a palaeontologist brought up in a creationist home. The family had read *The Genesis Flood*. So until his university days he was a young-earth creationist. But then he was introduced to evolutionary 'facts' and in a geology field trip he failed to see geology in the light of *The Genesis Flood*. He claims that the Bible is cosmologically out of date, but that the parts dealing with justice, mercy and forgiveness are not. Christians who accept evolution find that they are typically accused of reading the Bible inconsistently (see e.g. Barr[6]) and this has to be one the main reasons why in Darwin's double centenary, a project with four reports[16] had to be initiated by Christians keen to retain evolution, called 'Rescuing Darwin' (see below).

Scott and Grace Buchanan

Buchanan (Scott) is a chemical engineer. He met John Whitcomb of *The Genesis Flood*. But later he saw contradictions between geology and the Bible. By quoting Calvin ("God accommodated this revelation to the limited physical understanding of its ancient hearers"), that provided the final reason for them both to retain mainstream science and reject the creation as a series of fiats.

Philip Pattemore

Pattemore is a paediatrician. *The Genesis Flood* initially excited him, but he later realized that the main quotations were ancient and not typical of the twentieth century. Zoological issues, DNA and cladistics were the final nails in his creationist coffin. His own book of 2011 isn't referenced by Berry, but a review of it by Doyle[17] shows a consistent unwillingness by the author to engage with statements made by creationists rather than simply tackling the straw men of his own imagination.

Wilson Poon

Poon is a physicist and theologian. Although he devoured books by Josh McDowell, he felt at university that "creationism extracted a high price in cognitive dissonance". It is not clear exactly what he meant here. The final straw that broke his creationist camel's back was Dobzhansky's statement: "Nothing makes sense in biology except in the light of evolution." But a Christian could say: "Nothing makes sense in biology except in the light of *fiat* creation." Poon should have asked about the facts on which such as choice could be made. Making a statement at the end of his chapter that biological life "has evolved that way because of natural selection" sounds like lazy science.

Paul Thomas

Thomas is an ex-Muslim and as such was a strict creationist, though the details he would have followed were from the Koran (Adam made in heaven and delivered to earth) rather than the biblical version. Although later familiar with *The Genesis Flood*, he could not reconcile any science with the vapour canopy idea, or history even with the looser biblical chronology advocated in that book compared with the more recent creationist shorter chronology. So he was lost from creationism.

Denis Lamoureux

Lamoureux with qualifications in biology and theology was once an atheist. For a while he was a creationist, having been influenced by *The Genesis Flood* and Gish's reasoning. But on reading works by

J.I. Packer he accepted Packer's view that Genesis is poetic. Looking more closely at the fossil record without considering its problems[12] he then became an evolutionist.

Lamoureux's own book of 2008 is referenced by Berry. There is a review of it by Woodmorappe[18] which shows major gaps in Lamoureux's thinking, so there is no need to re-elaborate them here.

Michael Reiss

Reiss is a biologist and a former Fellow of the Royal Society. Although an evolutionist, he was hounded from the Royal Society when he suggested that teachers should be able to discuss creationism when pupils raised the subject. He was so confident that "evolutionary biology is good science", so it is hardly likely to be wrong. In this way teachers would be able to show that "scientific creation is not good science".

He does ask some basic questions about perceived problems with evolution. These include the fact that it contradicts the second law of thermodynamics and that there may be contradictions in the fossil record. But that is as far as he goes.

What does it all mean for creationists?

The Genesis Flood book (TGF)

One of the puzzles for creationists is that six (Godfrey, Buchanan, Giberson, Pattemore, Thomas and Lamoureux) of the individuals encountered *The Genesis Flood* and to some extent were inspired by it. As the book has had a tremendous impact upon the Christian world, what went wrong for these six? Unfortunately the contributors do not provide much in the way of details that allows us to respond to their problems. We wonder if they mentioned TGF more or less in passing, to suggest that they had studied creationist material in detail.

For one contributor, it was the fact that the TGF offered the concept of a vapour canopy as the major source of flood water. As that idea has since been shown to be physically limiting, he threw the whole thesis of TGF away. Admittedly there are some shortcomings in the TGF, but the major theses are still sustained. These theses are 1) that the Bible does not leave room for just a local or mythical flood in the mind of the author; 2) that geologists promoting uniformitarianism (e.g. Lyell) never tested the biblical story of the Flood; and 3) that there is much geological evidence of a rapid flood that occurred recently. For Berry's contributors to cling to the idea that the 55-year-old TGF is the latest word on creationism is convenient for them, but wrong.

For some who rejected the TGF theses, it was that the authors of TGF did not discuss genetics and other biological issues. But the TGF was simply a springboard into a wider range of studies. It was already a large book in its own right. There is plenty of material on these subjects now. And of course, once we discard the geological column, genetics is cast adrift because it loses its anchor in the 'fossil record'.

But by mentioning TGF, we see a bigger issue. Of those who changed their minds, and those who remained evolutionists, support for their position came from the theologians. And rarely did those quoted theologians such as Wenham, Packer, Kevan, and Kline consider TGF or wider issues of creationism. In particular, Wenham makes no mention of the TGF or its authors. His understanding of the Noachian Flood revolves around supposed J and P contributions to the final redaction of Genesis. What happened to McDowell's rejection of the Documentary Hypothesis that allowed this idea of contributions from J, E, D and P in the Pentateuch to continue in his mind? Remember, Poon recounts that he treasured McDowell. And the other problem we may have with Wenham's interpretation is that he assumes that the Epic of Gilgamesh came before Genesis. There is plenty of evidence to the contrary.[19] During his lectures, Wenham was rather coy about the subject when I tried to raise it.

This interpretation of Wenham's (namely ignoring TGF) may stem from the earlier work of Kidner.[14] TGF was written in 1961. In 1967,

Figure 1. Several contributors considered that the book *The Genesis Flood* could be ignored because it did not deal with genetics and DNA.

Kidner wrote a commentary on Genesis 1–8. Although he mentioned TGF, he could not accept that TGF was foundationally correct because so few scientists had abandoned their uniformitarian form of geology to embrace the idea that the Noachian Flood was a recent global event. But that misses the point that uniformitarian geology arose for the specific purpose of offering something other than biblical history for the geology of the world.[8] Geologists and other scientists wanted to get the clergy (and their anchor within the Mosaic scriptures) 'off their backs'. That is the biggest problem for Berry and his 18 contributors.

If we examine the writings of liberal theologians such as Barr, we find an interesting twist to the problem Berry *et al* face. Barr[6] notes that evangelicals take most of the Bible literally, but not the first few chapters of Genesis. Modern science has proved they are wrong. "How are the mighty fallen!" Barr says. "And how ridiculous a mouse has the mountain of fundamentalist interpretation [*i.e. evangelical theology*] brought forth" as a result of believing "that God 'only' made the world". To pretend that evangelism will be more successful (which is Berry's hope) amongst people such as liberals by abandoning creationism is therefore wrong.

Will the debate continue?

Obviously, Berry wishes that it would go away. The Buchanans felt that dogmatic debate does not help. McGeowan calls for churches to join the debate, and Reiss (though not so much in the book) welcomes discussions because he feels that it will end on a positive note for evolutionists.

In 2005, there was a major debate between the Rev. Professor John Polkinghorne (then Canon Theological) and Australian creationist John Mackay at Liverpool Cathedral, UK. Polkinghorne looked very uncomfortable, and did not even produce any visual aids. Polkinghorne has been an active member of Christians in Science, but their journals ignored the debate. Premier Radio, UK, did sponsor a wide range of debates on creationism and its fringe topics.

In 2009, the Theos Think Tank produced four reports[16] with the global title "Rescuing Darwin". Whilst the fourth report ("Doubting Darwin—creationism and evolution scepticism in Britain today") did mention some of the reasons why whole groups of Christians reject evolution, there was no subsequent attempt (in what should have been a fifth report which many creationists would have been willing to pay for) to try and address these issues provided by creationists.

Evangelism

Berry began his 1985 debate with the comment that:

> "... the continuing controversy [*between creation and evolution*] has undoubtedly been a stumbling block in evangelism since many who are not Christians regard the wrangling as a sign that Christians are out of touch with reality, and that the Christian God is irrelevant to ... everyday life."

Recognizing that according to opinion polls[16] there are about 20 million people in the UK who reject evolution, the Christian church has an amazing opportunity through creationism for evangelism.

For the sake of Christian witness, surely the time has come for a well-publicized fully recorded debate with those Christian scientists who support evolution such as Berry, Reiss or perhaps even Conway-Morris. That would focus on science. Then it would be time to engage with the theologians such as Wenham, Packer, etc on the theological issues, having sorted the science out. The book by Berry *et al* needs a response.

The alternative to debate, which could easily become dragged down into polemics, would be for regular, well-recorded discussions where we agree to differ, read each other's material and pursue evangelism from an agreed statement of where we differ and how we are attempting to resolve it.

References

1. Burke, D., (Ed), *Creation and Evolution,* InterVarsity Press, Leicester, 1985.
2. Wenham, G., *Word Biblical Commentary, Genesis 1-15,* Thomas Nelson, Nashville, TN, 1987.
3. Kevan, E.F., *The New Bible Commentary,* 2nd edn, InterVarsity Press, Leicester, UK, 1954.
4. Kline, M.G., *The New Bible Commentary Revised*, InterVarsity Press, Leicester, UK, 1970.
5. McDowell, J., *The New Evidence that demands a verdict,* Thomas Nelson, Nashville, TN, 1999.
6. Barr, J., *Fundamentalism,* SCM Press, London, 1981.
7. Rudwick, M.J.S., *Lyell and Darwin, Geologists,* Ashgate Variorum, 2005.
8. Matthews, J.D., The Legacy of Lawyer Lyell—his anti-Christian bias wrongly dominates geology, *CSM pamphlet,* Portsmouth, UK, Feb 2012.
9. Berry, R.J., The Fall is history, *Science and Christian Belief* **12**(1):53–63, 2000.
10. Addinall, P., The Fall: history or myth, *Science and Christian Belief* **12**(1): 47–52, 2000.
11. Conway Morris, S., *The Crucible of Creation*, Oxford University Press, 1998.
12. Matthews, J.D., The Stratigraphic Geological Column—a dead end, *J. Creation* **25**(1):98–103, 2011.
13. Whitcomb, J.C. and Morris, H., *The Genesis Flood,* The Presbyterian and Reformed Publishing Co, 1961.
14. Kidner, D., Genesis, InterVarsity Press, Leicester, UK, *1967.*
15. Bergman, J., The tragic toll of toxic teaching, *J. Creation* **25**(3):33–36, 2011.
16. Pharoah, R., Hale, T. and Rowe, B., Doubting Darwin, creationism and evolution scepticism in Britain today, *Theos report,* London, 2009.
17. Doyle, S., No keeper's brother, *J. Creation* **27**(3): 23–28, 2013.
18. Woodmorappe, J., Evolutionary creation—evolution rules supreme, *J. Creation* **27**(3): 17–22, 2013.
19. Sarfati, J., Noah's Flood and the Gilgamesh Epic, *J. Creation* **28**(4):12–17, 2006.

Europe clones America; the good, the bad, and the ugly

Creationism in Europe

Stefaan Blancke, Hans Henrik Hjermitslev and Peter C. Kjærgaard (Eds.)

Johns Hopkins University Press, Baltimore, MD, 2014

Jerry Bergman

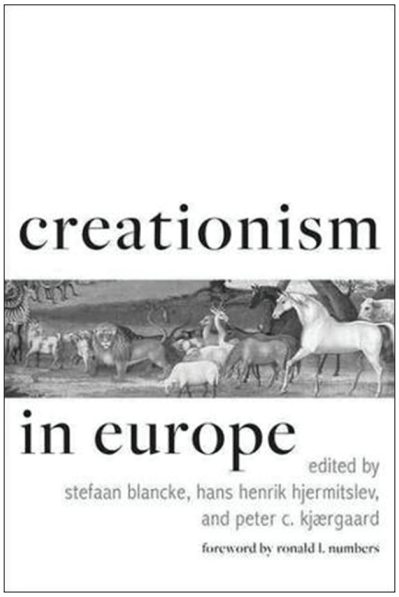
Creationism in Europe is a well-documented review of the status of creationism in 10 European countries. This work is in some ways a follow-up of my book *Slaughter of the Dissidents*, *Killing the Careers of Darwin Doubters*, only it focuses on Europe and my book focused on the United States. The authors, or at least the editors, are all Darwinists or ex-creationists, but most of the chapters were well done and fairly balanced, as the coverage of this subject should be in government schools. In contrast to what is common in writings by Darwinists on this subject, the authors largely avoided name-calling and derogatory innuendoes.

The authors discussed a number of highly credentialed scientists who have published in peer-reviewed science publications that support, or at least are sympathetic to, the creation and Intelligent Design (ID) worldviews. They also covered the sometimes strident opposition to all forms of creationism, which they defined as including not only ID but also theistic evolution. They documented that the common opposition to all Darwin Doubters by Darwinists that resulted from the growth of ID and creationism in Europe was sometimes irrational and aggressive.

Opposition to creationism

One of the countries that was most intolerant to creationism was France. The government controls the entire educational system to the degree that creationists and ID supporters involved in the science and academic professions often are even forced to "deny that they are creationists" in order to survive in their profession and retain the ability to earn a livelihood. This fact was mentioned by the author of this chapter, Thomas Lepeltier, to illustrate the difficulty in assessing the situation of Darwin Doubters in France (p. 15). Furthermore, any written material that openly questioned orthodox Darwinism is usually censored from French government schools. An example given to support this conclusion was a large quality hardbound book sent to all government schools in France that the authorities ordered removed from the schools to prevent student and faculty exposure to its contents.

Ironically, France was also the home of two of the leading scientists that had opposed Darwinism on scientific grounds, Albert Vandel (1894–1980) and Pierre-Paul Grassé (1895–1985) (figure 1). Until his retirement, Grassé was Chair of Evolutionary Biology at the Faculty of Paris. He was the author of over 300 publications, including the influential 52-volume *Traité de Zoologie*, a project in which he invested over 40 years to complete. His work was often quoted by Darwin Doubters. The two previous occupiers of the Sorbonne Zoology Chair, Alfred Giard (1846–1908) and Maurice Caullery (1868–1958), were also both Darwinism opponents (both were more supportive of Lamarckism).



Only after Grassé's retirement in 1965 was the chair occupied by a Darwinism supporter, Charles Bocquet (1918–1977).

Given this background, the hostility against Darwin Doubters is hard to understand, a task that the author of this chapter attempted to grapple with. The opposition to creationism has a lot to do with the rise of the well-funded aggressive Western anti-creation movement that has arisen since Professors Caullery and Grassé died.

The main leader of the "fight against creationism", and all Darwin Doubters in France, is Guillaume Leciontre (1964–), a professor at the Paris Museum of Natural History (p. 20). Part of the reason for the opposition to creationism is 30–40% of the French population declare themselves atheists or agnostics (p. 17). Most of the rest are nominal or cultural Catholics, most of whom are often not involved in any formal religious activities. Also, most French theologians reject all creationist worldviews and "accept Darwinian theory in its entirety" (p. 26).

So committed to evolution were some Darwinists that they condemned the film *Avatar* as "not being Darwinian and of promoting

intelligent design because [a character in the film] Pandora was designed too much like earth carbon based life" (p. 24). They argued that, if life evolved elsewhere, mutations and natural selection would evolve it to be very different than life on earth. Thus, they concluded, the film was "creationism in disguise", a "Trojan horse for American creationism" (p. 25). The largest group of creationism believers in France and several other countries are the Jehovah's Witnesses and Muslims (p. 18).

The influence of American creationists

American creationists have had a major influence on all of European creation groups. For example, the Protestant Catalonia publishing house, CLIE, "distributed a collection of Spanish translations of brief works on the question [of creationism] since 1979 under the general series title *Creación y ciencia* (Creation and Science)" (p. 37). One book was an anthology of articles about evolution and the fossil record written by Drs Duane T. Gish and Bolton Davidheiser.

The volume also included a brief contribution by a Spanish chemist and Protestant evangelical, Santiago Escuain, that centred on the discontinuities in the fossil record. Escuain wrote that the fossil record not only does not "provide any support to evolutionism, but it is openly hostile to it" (p. 37). Escuain is "also a promoter of *Servicio Evangélico de Documentación e Información* (SEDIN, Evangelical Service for Documentation and Information)", a platform for sending textbooks and news related to creationism to their denomination members (p. 37).

For several years, the *Creación y ciencia* series added new titles, almost all translations of creationist works by well-known American creationists including Henry M. Morris, Willem Ouweneel, Harold S. Slusher, Thomas G. Barnes, and John C. Whitcomb. Dr Whitcomb and Morris's classic *The Genesis Flood* and Phillip E. Johnson's *Darwin on Trial* were especially influential in Europe (p. 37).

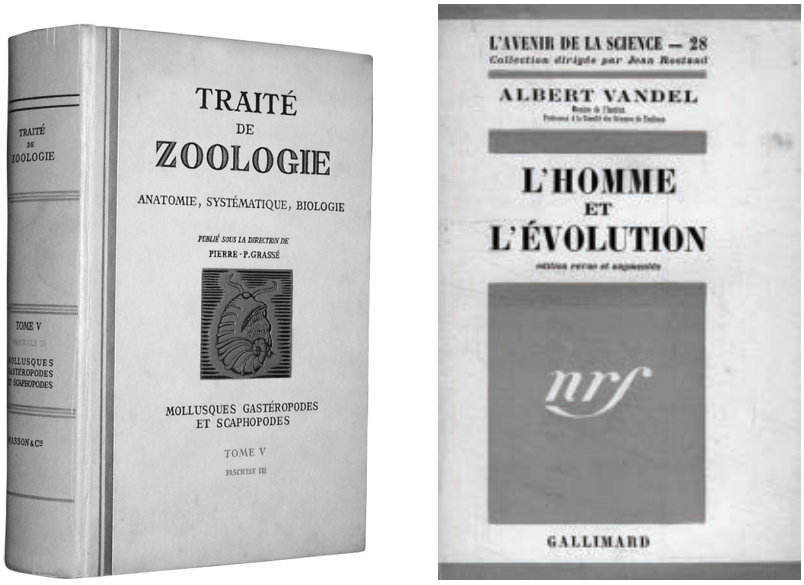


Figure 1. Books by two of the leading French scientists, Albert Vandel (1894–1980) and Pierre-Paul Grassé (1895–1985), that have opposed Darwinism on scientific grounds

Censorship

Censorship is also a major problem in Europe as it is in America. For example, the Physicians and Surgeons for Scientific Integrity (PSSI), sponsored a lecture series in Spain in January of 2008. The speakers included Dr Thomas Woodward from Florida and author of *Darwin Strikes Back;* Geoffrey Simmons, a physician and fellow member of the Discovery Institute; Swiss engineer, Isaac Lorencez; and Spanish ophthalmologist and PSSI member Antonio Martínez. The planned 10 lectures, two per city, were given in Madrid, Barcelona, Malaga, Leon, and Vigo, but in the last two cities they were able to give only one lecture

> "… because the local universities refused to provide a venue. These educational institutions had been warned by the Sociedad Española de Biología Evolutiva (SESBE, Spanish Society for Evolutionary Biology) about the creationist orientation of PPSI [or PSSI]" (p. 41).

Another example of censorship occurred even before the lecture tour, when the Spanish Society for Evolutionary Biology warned the university administration in Gijon about "sponsoring a talk by the Cuban American astronomer Guillermo Gonzalez, senior fellow of the Discovery Institute" (pp. 41–42). This action

> "… provoked a debate in the media about freedom of expression and the limits of science and scientific teaching. In some respects, there were certain resemblances to earlier controversies on evolutionism in Spain. The tone of the president of SESBE, Manuel Soler, is particularly significant. With regard to PSSI and its lecture series, he wrote: 'This invasion is a very serious attempt to win [the battle of ideas] that will surely continue. We have to get ready for the defense … Now Militant atheists are among the main leaders of the anti-creation campaign, as indicated by

> the military metaphors they used which revealed a grave concern about allowing a presentation against Darwinism in universities in response to a situation that many "… evolutionary scientists consider alarming. The rhetoric of warfare is encouraged by some scientists who not only declare themselves as atheists but also scorn the religious attitudes of some of their colleagues" (p. 42).
>
> An example is:
>
> '… evolutionary ecologist Santiago Merino used a review of Richard Dawkins's *The God Delusion* for expressing his surprise when he finds scientists defending the compatibility between science and religion. Similarly, geneticist Arcadi Navarro assesses Francis Collins's *The Language of God* as a 'vehement but impossible attempt to reconcile God … with the scientific advances to which he himself has contributed' and claims that Collins deceives himself [in believing in God as the Creator]" (p. 42).

Another example of the strident, sometimes irrational, opposition to creationism occurred in Britain. This case on the "effect of outspoken evolutionists on the creationism debate" involved the director of education of the Royal Society, Professor Michael Reiss. In 2008 he was forced "to resign after stating in a public lecture that science teachers should deal with creationism if a child raised the topic" (p. 60). If asked questions in class on this topic, he responded:

> "… science teachers should explain why evolution was a scientific theory and creationism was not. The lecture was misrepresented in various media reports claiming that Reiss was not only professor of science education in London with a doctorate in evolutionary biology but also an ordained minister in the Church of England. Some atheist members of the Royal Society wrote protest letters arguing that a priest could not represent a scientific institution such as the Royal Society, eventually resulting in Reiss's resignation" (pp. 60–61).

This event "alienated many religious people in Britain, and creationist organizations used this story as evidence to show that religious thinkers and scientists were excluded from science on grounds of their personal belief" (pp. 60–61). Another example, this one in France, involved the Christian paleoanthropologist Anne Dambricourt-Malasse (1959–) whose interpretation of "human evolution has generated much controversy". For example, a television documentary involving a discussion of her creation theory, *Homo sapiens*: une nouvelle histoire (*Homo sapiens*: a new history), was scheduled to be shown on the national TV channel, ARTE, in October 2005. When

> "… the program was announced, Guillaume Lecointre and some of his colleagues organized a campaign to put pressure on ARTE, accusing the documentary of pushing a creationist agenda in disguise. Part of the press joined the protest, highlighting the 'scandal' it would be to broadcast a creationist documentary on public channel in a secular state" (p. 22).

In order to accommodate the opposition to creation "it was decided that the channel should host a 'debate' immediately following the program" in which "only outspoken critics were invited" who evolutionists felt could easily "discredit the documentary's scientific claims" (p. 22). This event

> "… highlights the tensions provoked by any questioning of Darwinism in France. The question remains whether the Dambicourt-Malasse thesis and more generally, the conceptions of UIP [Interdisciplinary University of Paris] belong to the intelligent design movement. To many, their implicit association is evident. For example, in January 2006, under the headline "The Bible against Darwin", several articles in a special issue of a major weekly magazine, *Le Nouvel Observateur*, described the theses defended by UIP as a French version of intelligent design. This charge was also brought in an article in *Le Monde* in 2006 entitled 'French Neo-creationism in Disguise'. Other media have been equally critical of UIP" (p. 22).

A case in Germany involved some creationist professors who were able to publish a scientific article in the international scientific literature. Specifically, they managed to publish an "article in the highly esteemed journal *Trends in Ecology and Evolution*" (p. 124).[1] Although they did not explicitly refer to creationism,

> "… they wrote that 'the hypothetical descent of mankind from 'mitochondrial Eve' has been much debated … . Nobody was actually there … . If molecular evolution is really neutral at these sites, such a high mutation rate would indicate that Eve lived about 6,500 years ago" (p. 124).

Another example is the publication of an article in "the respected German scientific journal *Naturwissenschaftliche Rundschau*" that explained

> "… the apparent young age of particular species of cichlids, noting that 'the biologists Junker and Scherer regard the explosive speciation events as a process that is caused by polyvalent basic types with a built-in capacity for variation.' When informed of this surreptitious promotion for a creationist model, the editor pledged not to accept such a manuscript again" (p. 124).

Yet another example was a scientist at the Max Planck Institute for Plant Breeding Research in Cologne, Germany, Wolf-Ekkehard Lönnig, who with a colleague published a review article in a high-impact journal, in which

> "… they discussed the possibility of a 'partly predetermined generation of biodiversity and new species'. They claimed that the origin of higher systematic categories depends on the 'genesis of irreducibly complex structures' and referred to the publications by the American intelligent design proponents Michael Behe and William Dembski. To conclude, they argued that we should 'continue to welcome the plethora of different and diverging ideas and hypotheses on the origin of life … wherever they may lead'" (p. 124).

Since then it has become virtually impossible for out-of-the-closet Darwin skeptics to publish in German science journals. Lönnig was even forced to shut down his ID-friendly website.

Scandinavia

Scandinavia is a "society without God" (p. 85), where a total 83% of Danes, 82% of Swedes, and 74% of Norwegians believe humans evolved from some earlier animal species (p. 85). Furthermore, only 2–5% of Scandinavians attend church on a regular basis (pp. 85–86). One factor influencing the number is that in the two decades after Darwin published his *Origin* book in 1859, all natural history museums and all five Scandinavian universities began to integrate evolution as their presupposition for all research and teaching (p. 87). Also, as is true in most of Europe, the Jehovah's Witnesses, "which is among the largest Christian denominations outside the national churches in Scandinavia", have aggressively promoted "their version of creationism in pamphlets and books offered free of charge" to a wide audience of persons (p. 95).

As is true of Europe, American creationist writings began to appear in Scandinavia in the 1970s (p. 90). Several creationist organizations were formed at about this time and numerous creationist and ID books were translated into several Scandinavian languages. The editorial boards of these creation groups included several scientists with graduate degrees in science (p. 93). Also, as is true in all of Europe, a backlash soon occurred in Scandinavia. For example, the Swedish 'conservative' government banned the teaching

> "… of creationism and intelligent design from biology classes in state-funded Christian schools. Its decision was made shortly after the passing of the Council of Europe 1580, which warned against 'the dangers of creationism for education' in October 2007,[2] and it was supported by the Christian Democrats, even though some of its evangelical members aired creationist views (pp. 94–95).

In a chapter titled The Rise of Anti-Creation in Europe, the author documented the source of many of these anti-creation efforts as atheists, agnostics, and humanists. One result was the European Convention on Human Rights council passed resolution 1580 by a 48 to 25 vote, which urged member states to firmly oppose the presentation of any information in schools that supported creation or opposed Darwinism. The resolution was justified by claiming concerns about the potential adverse effect of

> "… the spread of creationist ideas within our education systems and about the consequences for our democracies. If we are not careful, creationism could become a threat to human rights, which are a key concern of the Council of Europe" (p. 233).

The reasoning they used was that science plays a central role in the economic, technological, and social development of all European countries, and thus was "a stabilizing factor in the foundation for sustaining successful democracies. Creationist groups were cast as antiscientific", which is why the convention interpreted them as "one of the most serious threats to human and civic rights" in Europe today (p. 233). Furthermore, resolution 1580 added that the "war on the theory of evolution and on its proponents" often originated from

> "… various forms of religious extremism closely linked to extreme right-wing political movements and thus directly to antidemocratic activism. This had to be taken seriously as it was claimed that the 'creationist movements possess real political power'" (p. 233).

Conclusion

In conclusion, this book is an excellent, fairly balanced review of the situation of Darwin Doubters in Europe. It covers both the progress that creationism and ID has made in Europe and the sometimes militant backlash, which is often influenced by humanists, atheists, and agnostics. It also details some of the academics that are supportive of creationism, or at least are critics of Darwinism. I can here only briefly review some of the material covered in this important reference.

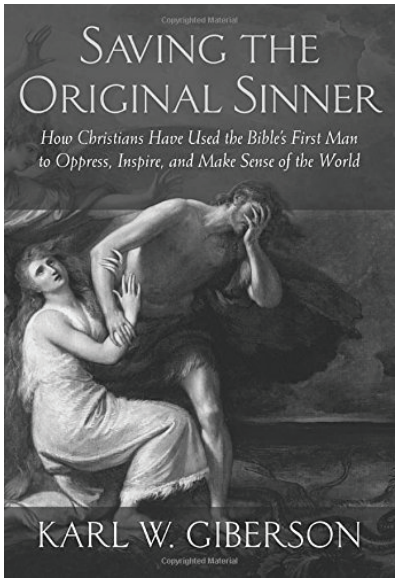
References

1. Loewe, L. and Scherer, S., Mitochondrial Eve: the plot thickens, *Trends in Ecology and Evolution* **12**(11):422–423, November 1997.
2. See critique, Sarfati, J. and Catchpoole, D., When will Europe wake up? Council of Europe 'condemns creationism' (but it ought to reconsider where the 'threat to human and civic rights' is really coming from), creation.com/Europe, 1 February 2008.

An evolution-imbibing compromising evangelical and his left-wing ideology

Saving the Original Sinner
Karl W. Giberson
Beacon Press, Boston, MA, 2015

John Woodmorappe



The author is identified as a teacher of science and religion at Stonehill College. This book offers nothing new. It is not, as the reader may assume from the title, a book about Adam and Eve (figure 1). Rather, it is a superficial and overgeneralized history of Christianity, as imagined by the author, and supplemented with a series of jibes, straight out of secular leftist ideology, directed at American evangelical Christianity. Giberson's remarks about creationism are especially uninformed. They betray very little, if any, understanding of the issues involved.

The reader might be forgiven for seeing the first part of this book as just one long whine, by the author, about his personal experiences. He relates how he once believed in Special Creation, how he became impressed by the 'evidences' for evolution, but then goes on to bemoan how he felt uncomfortable in the Christian college in which he taught, how he was frustrated by doctrinal 'gatekeepers' there, how he left the university, and how he got a new job in a so-called Christian university that welcomes challengers to orthodoxy. He portrays himself as a persecuted heretic and martyr, at one point even juxtaposing himself with Galileo!

The role of presuppositions

The author scoffs at the notion (presented, for example, at the Creation Museum in Kentucky) that one's starting point determines whether one believes in evolution or Special Creation. Instead, he would have us believe that it all depends upon 'evidence'. His offhanded dismissal of the reality of presuppositions borders on the naïve.

Giberson seems to have no understanding of how one's *a priori* assumptions determine what evidence is acceptable, what (if any) limits there are to human reason, whether or not God's Word is more authoritative than human reason (including science), what (if any) role God plays in the universe, and especially how the evidence is interpreted.

One's worldview is crucial. This is no American fundamentalist imagination. In fact, the Germans, as part of their philosophy, have their term for it—*Weltanschauung*. One's worldview makes all the difference in the world.

Heterodox thinking at universities

Giberson's remarks about evangelical colleges acting against evolution-believing professors need to be clarified. There is no valid symmetry between evangelical colleges censuring professors that deviate from biblical orthodoxy, and secular colleges censuring evolution-questioning professors. Let us elaborate.

Christian colleges are not neutral institutions. They are exclusive, private schools. They openly exist in order to promote a certain worldview and religion. In the US, at least, Christian colleges receive no taxpayer monies, so their only support is from those who choose to attend them.

Secular colleges, on the other hand, are (or are supposed to be) neutral institutions—inclusive, public, and pluralistic in every way. Secular colleges receive taxpayer moneys and should therefore, all the more, be neutral in viewpoint.

This asymmetry has practical consequences. The one who chooses to teach in an evangelical college knowingly enters an environment where there is a biblical orthodoxy which is to be upheld. He or she knows beforehand that deviation from this orthodoxy can result in censure, or even termination, just as surely as a Christian professor who converts to another religion could reasonably expect to face dismissal. No-one is forced to subject himself or herself to these strictures because no-one is forced to teach in an evangelical college.

On the other hand, the one who chooses to teach in a secular college enters an environment where he or she expects to be viewpoint-neutral and where he or she expects not to be censured or terminated for holding to

non-conformist or unpopular views. Consequently, for all these reasons, the dismissal of a non-conformist professor from an evangelical college is acceptable, but the dismissal of a non-conformist professor from a secular college is an intolerable act.

Finally, Giberson's laments are devoid of perspective. He is effectively complaining about all the water in the lakes of the world, while ignoring what is much more significant–all the water that is in the oceans of the world. Secular colleges, to say nothing of nominally Christian colleges, outnumber evangelical ones by many multiples. More and more, secular colleges are becoming hotbeds of intolerance against Christianity and against traditional moral values. Christians are demonized and silenced, and commonly face discrimination. It is more and more difficult for professors who are not political leftists to get tenure. A study of 1,643 full-time faculty at 183 four-year schools found that political leftists outnumber political conservatives by 87% to 13%, while 51% rarely or never attend church or synagogue and less than a third attend services regularly.[1] Secular college is getting further and further away from the neutral forum that it is supposed to be. Ironically, this is what creates a demand for evangelical colleges in the first place!

Secular colleges are dominated by humanism and are thoroughly evolutionized. So are a great many so-called Christian colleges. This is a long way from the founding of the University by the Church in the Middle Ages, and the founding of the earliest and most prestigious American universities by Christians. What, then, is so terrible if some evangelical colleges dare buck the trend, offer a dissent to the prevailing evolutionary worldview, and maintain a faculty that consistently supports this dissent?

Genesis 1 bows in homage to evolution

Many compromising evangelicals had, in the past, tried to spin a contrived ambiguity about Genesis 1, in a transparent but less-than-candid attempt to force it to agree with evolution. They had us believe that we could not really know what Genesis 1 meant, and so there were dozens of equally valid interpretations of it. The days in Genesis 1 may be non-literal. They can be unequal to each other in length. There may be one or more gaps between them. Better yet, they can overlap.

In contrast, Karl Giberson recognizes the fact that the unembellished interpretation of Genesis 1, held almost universally until recently, had unambiguously pointed to a literal Adam and Eve (figure 1). He comments:

> "Most expressions of Christianity, from Augustine to Al Mohler, have never been without a historical Adam and Eve, despite more liberal Protestant traditions moving in that direction as early as the nineteenth century. And even as evolution was tentatively embraced by sophisticated evangelicals over the course of the twentieth century, Adam and Eve were inserted somewhere" (p. 10).

Unlike those compromising evangelicals who are kidding themselves about what they are doing and why they are doing it, Giberson is not. He is forthright about the fact that any 'reinterpretation' of Genesis 1, and Adam and Eve, is nothing more than a sop to evolution. He continues the statement quoted above, on Adam and Eve being "inserted somewhere", as follows, "And, then, as mounting evidence made that insertion ever more implausible, theological pressures were brought to bear" (p. 10).

Giberson's comments perfectly demonstrate the fatal problem of being a compromising evangelical—of trying to have a foot in both camps. What takes place when you try to do that? First the Bible is twisted and redefined to bow in homage to evolution. Then a new development

Figure 1. Adam and Eve have always been understood to be literal human individuals.

in evolutionary thinking arises. Because of this, the original twisting and redefinition of the Bible does not work any longer. So what happens? Is the futility of compromise finally recognized? Not at all. The Bible is again twisted and redefined—in another way, and even more severely than before—to keep it in the position of prostrate homage to evolution. Then the cycle repeats itself.

Worse yet, Giberson is now so impressed by 'science' that he appears close to giving up any pretence of harmonizing Genesis and 'science'. He quips:

> "No Christian thinker has found a satisfactory resolution to the origin of sin, the nature and extent of the curse, and the closely related *problem of evil*. Adam and Eve are part of this mystery … . The challenge of taking God's Two Books seriously has grown dramatically in recent years as genetic evidence has made it clear that Adam and Eve cannot have been historical figures, at least as described in the Bible. More scientifically informed evangelicals within the conservative traditions are admitting that the evidence is undermining creation, fall, redemption theology. … The task is beginning to look impossible from any perspective, as we will now see from the implausible and inconsistent proposals that are circulating [emphasis in original]" (pp. 167–168).

The author never tires of hammering this point. Giberson restates that "Adam and Eve, as described in Genesis, cannot have been historical figures. Recent work in genetics has established this unsettling truth beyond any reasonable doubt" (p. 173). Oh, really? *Not once* does Giberson tell us what this evidence is!

A more fundamental question needs to be raised: Who is one's god? Is God one's god or is evolution one's god? The answer, unfortunately, seems obvious in the case of Karl W. Giberson.

A subtle hostility to Christianity

The author would have us believe that the doctrine of the Divine inspiration of Scripture implies mechanical dictation of the words and absence of the human element in the Bible (p. 23). What a ridiculous straw-man Giberson has made!

The author uses the BCE/CE system instead of BC and AD (e.g. p. 100). Is this incidental or does it imply a devaluation of Christianity?

Casting aspersions on Adam and Eve

Giberson repeats left-wing and atheist talking points, blaming the Adam and Eve account for such things as opposition to homosexuality and, earlier, the justification for the subordination of blacks and women.

However, based solely on the information that Giberson provides, his contention becomes self-refuting. It quickly becomes obvious that there is no straightforward relationship between Adam and Eve and the past attitudes of whites towards non-white peoples. So personal interpretation abounded. Some racists rejected monogenism and argued that blacks were too primitive to have been descended from Adam and Eve. Abolitionists, as well as some racists, accepted monogenism. The latter argued that non-whites were degenerate descendants of Adam and Eve. Both sides, during the American Civil War, cited Adam and Eve to support their positions. The difference is that the racist side invented interpretations never seen except in racist societies, showing that the racism was read *into* Scripture rather than exegeted *from* Scripture. Furthermore, almost all the early Darwinists were racists and eugenicists—including Darwin's own cousin and sons.[2,3]

Interestingly, Giberson brings up a modern development—*The Bell Curve*—which he regards as a justification of racism. He thus unwittingly demolishes his own argument about the Adam-and-Eve account being a foundation of racism. Obviously, without even mentioning the racism of Darwinism, we can see that institutionalized racism can do just fine without belief in Adam and Eve.

As for sexism, Giberson dusts off the old feminist accusation of Genesis 2 blaming women in general because Eve first partook of the forbidden fruit. However, this is vitiated by the fact that it is also called the Sin of Adam. Both Adam and Eve, and not only Eve, were expelled from the Garden of Eden, and Paul links death to Adam's sin in Romans 5:12–19 and 1 Corinthians 15:21–22.

Had Genesis 1 been designed to teach the subservience of women to men, it would probably have said that Eve was created from Adam's foot, and not from his side. Had it intended to communicate a contempt for women, it could have taught that Eve was made from Adam's bodily waste, or something to that effect. Instead, the Genesis account has the creation of Eve from Adam's side, which makes her the equal of Adam.

Of course, it is possible that the two genders have differential vulnerabilities to particular sins, and this differential rests upon the greater female, and lesser male, sensitivity to spiritual stimuli. Thus, females may be more prone to be enticed by forbidden spiritual experiences, while males may be more prone to be enticed by spiritual indifference. This, in turn, could explain why women have always been overrepresented in witchcraft, while men have always been overrepresented among the unchurched.

If so, both tendencies can simultaneously explain Satan's strategy in causing the Fall. His enticing of Eve was based on her vulnerability to a forbidden experience *and* was simultaneously based on the vulnerability of Adam to spiritual indifference (inadequate spiritual

leadership). Both Adam and Eve are thus equally guilty.

On another subject, the author brings up Adam and Eve as a contra-distinction to 'Adam and Steve'. Here, for once, he is correct. There is no doubt about the fact that God's model for marriage is one man and one woman, and that homosexuality has no legitimacy in the Word of God. Jesus evidently agreed by citing this account to show God's design for marriage: one man and one woman (Matthew 19:3–6). It would seem that Giberson knows better than Jesus.

Another hatchet job: American Christians are racist

Giberson takes another run at Christianity as he dusts off Martin Luther King's 1963 remark about 11 am Sunday mornings being the most segregated hour in America (p. 135). He accuses the American church, even today, of being more segregated than schools, the military, businesses, etc. The insinuation is obvious.

The author's complete superficiality in terms of sociology is no less extreme and flippant than that evidenced in his treatment of science and religion. Let us examine some elementary facts.

African-Americans tend to be concentrated in large urban areas. Residential patterns in the US still tend to be segregated. On this basis alone, it is hardly surprising that most attendees in a black neighbourhood church are black, and most attendees in a white neighbourhood church are white. Megachurches, where race mixing is more likely to occur because worshippers theoretically are more likely to come from a variety of neighbourhoods, are still the exception. But even then, because megachurches tend to occur in the suburban areas of large American urban centres, these congregations still tend to be overwhelmingly white.

In his illegitimate argumentation, Giberson conflates churches, which are private institutions where race mixing is not compelled, with public institutions that, by their very nature, require race mixing (by law and/or circumstances), such as businesses, schools, the military, etc. Complaining that churches are more segregated than public institutions, for this reason alone, is like comparing apples and oranges. It is beyond ludicrous.

Giberson would have us think that segregation is necessarily malevolent in nature. It is not. Self-segregation is usually not motivated by racism. It is motivated by preferring to associate with one's own. For this reason alone, most Americans live in neighbourhoods that are primarily of the same race as they are. The desire to associate preferentially with one's own means that the vast majority of the friends of white people are other white people, and the vast majority of the friends of black people are other black people. Since churches tend to be associations of family and friends, it is hardly surprising that they tend to (at least predominantly) be of one race or another. (However, I have been to many American evangelical churches where significant race mixing takes place.)

Other factors come into play in tending to reinforce black-and-white self-segregation in American churches. African-Americans tend to be a distinctive, even enclave, subculture. African-Americans, for example, tend to prefer more emotional styles of worship than most Caucasian-Americans would be comfortable with. African-American churches are commonly politicized, with a mixing of religion and politics according to matters of specific identity with, and of interest to, African-Americans. On the other hand, African-American Christians often feel that white evangelical churches are insufficiently concerned about social injustices.

Indeed, the underlying phenomenon is primarily *cultural* rather than racial, as extensively documented by the African-American economist Thomas Sowell.[4] For instance, Northern blacks objected to the influx of the culturally different Southern blacks after the Civil War. The same applied to the early waves of Jewish immigrants to New York—Jews from Germany tended not to mix with the racially identical but culturally distinct Jews from Eastern Europe.

Clearly, self-segregation in American evangelical Christianity is a many-faceted phenomenon. Korean-American Christians tend to attend Korean-American churches. Are they also bad? According to Giberson's unsophisticated reasoning, they are.

The foregoing is not meant to imply that there are no racially motivated divisions among Americans. There are. However, contrary to Giberson's attack on Christians in general, and the Book of Genesis in particular, they are not the ones primarily responsible for the persistence of racial problems in the US. The primary blame rests with over 50 years of liberal politics. Liberalism has transformed American history classes to ones where there is a strong over-emphasis on slavery and past racial injustices—seemingly designed to keep younger generations of African-Americans thinking that they are perpetual victims.

But as the African-American economist Walter Williams often says:

> "Most of the problems faced by the black community have their roots in a black culture that differs significantly from the black culture of yesteryear. Today only 35 percent of black children are raised in two-parent households, but as far back as 1880, in Philadelphia, 75 percent of black children were raised in two-parent households—and it was as high as 85 percent in other places. Even during slavery, in which marriage was forbidden, most black children were raised with two biological parents. The black family managed to survive several centuries of slavery and generations of the harshest racism

and Jim Crow, to ultimately become destroyed by the welfare state."[5]

It never ends. Decades of ever-more-expansive social programs fostered by liberals have tended to make America's minorities dependent upon them—so much so that America's Democratic Party, the main purveyor of these programs, can reliably count on 90–95% of the African-American vote. In addition, the liberals' affirmative action programs (racial quotas and hiring preferences), even if well-intentioned, have directly pitted blacks against whites, thus perpetuating racial polarity and hindering the emergence of an American post-racial or colourblind society. They have also caused many black students to fail because lower admission standards mean that they are mismatched to the elite universities they attend, whereas they would probably have passed at less rigorous universities.[6]

Finally, there are psychological tests that purportedly measure biases that most people are not even aware of. These supposedly show that most people retain subtle biases against members of other races. If valid, they show that racial bias is no evangelical Christian problem. It is much more fundamental—a problem of the human condition.

The corruption of language

Several years ago, Giberson tried to redefine biblical terms to make them fit evolution. Before describing the unfavourable reaction he got from fellow evangelicals, he reminds us what he had proposed:

> "I suggested that what is labeled theologically as sin remains a useful insight into human nature, even after we abandon a historical Adam, his fall [note small letter], and the original sin he passed on to us. … The story of Adam is thus the story of Everyman, unable to resist temptation, ignoring the better angels of his nature" (p. 170).

What happens when we redefine Adam? In the first place, the redefining of terms makes language itself increasingly ambiguous. Imagine someone lost his glove and insisted, with a straight face, that he had lost his sock. To him, 'sock' means 'glove'. So he has redefined 'glove' to mean 'sock'. If this bastardization of language were to go on and becomes popularized, terms such as 'glove' and 'sock' would no longer mean anything specific.

This has an even greater bearing on theology—where the stakes are so much higher than something as trivial as the distinction of a sock from a glove. If one is to redefine Adam, as Giberson does, why stop there? Why not redefine God? In fact, redefinition of God already takes place. Liberals have rejected Him as the Supreme Being, and have redefined him as 'the ground of being', the beautiful aspects of nature, or some other vacuous construct.

The redefinition of terms does not merely cause ambiguity and confusion. It can, or does, change the way people think, so that their mental (and spiritual) concepts are fundamentally altered. This was, for example, done intentionally by the totalitarian government in George Orwell's *1984*, not only to make English more logical, but to profoundly change the way that people think, and to muddle or eliminate 'unwanted' ideas. That is why Newspeak was developed and put into use. In Oldspeak, the phrase 'All men are equal' evoked the thought that all human beings are endowed with the same rights. In Newspeak, the replacing phrase became 'All mans are equal'. This would now mean, for example, that all humans are exactly the same size—a physical impossibility—and it deliberately eliminated the very idea that all humans have the same rights.

In like manner, the redefinition of God and the redefinition of Adam not only causes confusion, it also creates muddled thinking and spiritual emptiness. No wonder that so many 'Christians' in the West are not actually Christians, and why so many people have vague and erroneous ideas of what it means to be a Christian.

Finally, the redefinition of theological terms is a form of intellectual dishonesty. If one rejects a supreme being, that is one thing. If one loves nature, that is also one thing, but don't call that God! Likewise, if, as is true of Giberson, one rejects a historical Adam, that is fine. If one believes in Everyman, that is also fine. But don't call him Adam!

A piddling of science

The poorest-quality part of this book is the section on science. Giberson makes flippant remarks about creationism. He glibly and effortlessly repeats stock arguments without evidence of any thought, much less deep thought. These arguments include all the old saw about 'bad design', especially the human knee, the tailbone, the appendix, and pseudogenes. To crown the silliness, he asks, "Did God really create all these second-rate systems?" (p. 163). In doing so, Giberson shows not the slightest awareness, much less understanding, of creationist refutations of these 'problems', often a long time ago. Furthermore, Giberson must answer the question in the affirmative, because God allegedly used evolution to 'create' these supposedly bad things.

The author insists that *raqia* can only mean that the sky is a solid dome. However, his reasoning is very superficial, and he does not satisfactorily explain why he thinks that this must be so. Once again, the claim has been refuted long ago.[7]

Conclusion

One can often feel stimulated by well-reasoned books that one does not agree with. In my opinion, this is definitely not one of them. I frankly found this book so shallow that I regretted the waste of time in reading

it. The content is trite and the book has nothing new to offer. It is one long lament about Genesis 1 and about how it got him into trouble at a Christian university.

Personally, I am surprised at the adulation that Giberson has gotten, considering the apparent extraordinary shallowness of his thinking. On the other hand, perhaps I should not be so surprised. In some circles, any soi-disant evangelical who becomes a mouthpiece for evolution, and—better yet—promotes leftist ideology, becomes an instant hero.

References

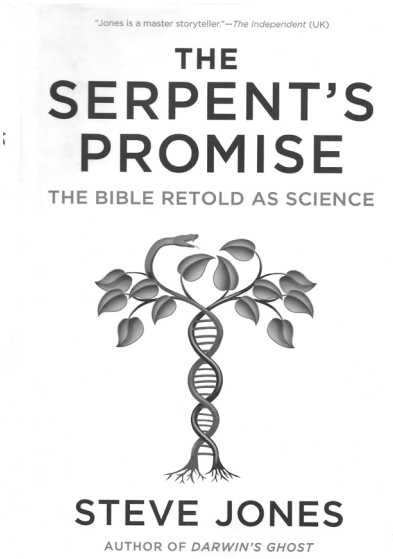
1. Rothman, S., Lichter, S.R. and Nevitte, N., Politics and professional advancement among college faculty, *The Forum* **3**(1):2, 2005.
2. Sewell, D., *The Political Gene: How Darwin's Ideas Changed Politics,* Picador, London, 2009.
3. Bergman, J., Darwin is the universal acid that affects everything (review of Sewell, ref. 2, *J. Creation* **25**(1):19–21, 2011.
4. E.g. Sowell, T., *Black Rednecks and White Liberals*, Encounter Books 2006. The title refers to Sowell's extensive documentation that much allegedly authentic 'black culture', including 'ebonic' dialects, is actually a vestige of a disfunctional *white* southern redneck culture. This in turn came from the 'cracker culture' from the regions in Britain, mainly on the harsh English border, they emigrated from. This includes "an aversion to work, proneness to violence, neglect of education, sexual promiscuity, improvidence, drunkenness, lack of entrepreneurship, reckless searches for excitement, lively music and dance, and a style of religious oratory marked by strident rhetoric, unbridled emotions, and flamboyant imagery" (p. 6).
5. E.g. Williams, W.E., Black people duped, *jewishworldreview.com*, 5 March 2014.
6. This pattern is repeated everywhere affirmative action is tried, as documented by Sowell, T., *Affirmative Action Around the World: An Empirical Study*, Yale University Press, 2005.
7. Holding, J.P., Is the *raqiya'* ('firmament') a solid dome? *J. Creation* **13**(2):44–51, 1999; creation.com/raqiya.

A sugar-coated attack on Judeo-Christianity

The Serpent's Promise: The Bible Retold as Science

Steve Jones

Doubleday Publishing, 2013



John Woodmorappe

Author Steve Jones was the former head of the Department of Genetics at University College, London. He also was involved in universities in Africa, the United States, and Australia. He has also been distinguished and honoured for his role in promoting the public understanding of evolution.

The title of this book is straightforward. It refers to Satan's promise, to Adam, that he would become wise if he partook of the forbidden fruit.

This book promises much more than it delivers. Jones claims to "stand back and take a fresh look at the sacred writings" (p. 5). He does not. In fact, he admits that his own reconsideration of the Bible "is quite free of any taint of originality" (p. 14). That is quite an understatement! What he says turns out to be the same old, same old infidel drivel.

In addition, the reader will quickly find out that the book is quite unfocused. In fact, his book is a hodge-podge of numerous, unrelated topics thrown together.

Religion and science—not separate magisteria

Nowadays, at least in the USA, the conflict between the Bible and evolution is usually resolved (actually, circumvented) by the contention that science and religion are non-overlapping magisteria. This serves as a sop to compromise-minded believers and a stick against those who recognize biblical truth. For example, in court decisions against creationists, judges have commonly talked down to creationists for "showing a misunderstanding of both science and religion", as if judges are experts on either.

In other words, science and religion are supposed to have completely different purposes, and to function in separate, watertight compartments. Jones will have none of it. He writes:

> "In a covert attempt to accept that failing, some try to have a foot in both camps. They suggest that objective analysis can only go so far and that there must be another truth beyond. … The notion that science and doctrine occupy separate, or even complementary, universes and that each provides an equally valid insight into the world seems to me unconvincing and is pursued no further here" (p. 5).

Does the miraculous equal superstition?

To the author, it does. Jones' concept of the nature of belief in miraculous events is totally defective. He appears to hold to radical empiricism: If something cannot be demonstrated by observation and experimentation, it therefore does not exist. However, no observation or attempt can demonstrate radical empiricism, so this is self-refuting.

Jones naively dismisses the miraculous as based on superstition, dogmatic authoritarianism, and the wish for something to be true. Moreover, according to Jones, "it's all the same" when it comes to miraculous claims, no matter who makes them. This reminds me of the silly argument of prominent British philosopher and atheist Bertrand Russell, who once said that there was just as much evidence for the miracles of the Homeric gods as there is for the Christian God.

Actually, miraculous events, no less than 'normal' events, can be tested—not through the scientific method (using observation and experimentation), but as historical events. On this basis, the miracles in the Old and New Testaments have much greater credibility than the miracles of other religions, and certainly have much greater credibility than the miracles in folklore. On this basis, belief in the miracles of the Bible is not based on wishful thinking or superstition. It is rational.

It is, of course, true that religion includes the belief in events that cannot be empirically tested but, as elaborated in the next paragraph, the same can be said about many beliefs in 'science', especially evolutionary theory. In addition, religion (notably the Christian religion) is much more than dogma. There is much room for independent thinking within Christianity, which is why there have been many theological disputes about issues. It is also precisely the reason that modern science originated and developed in a Christian cultural matrix.[1]

Who is it that engages in credulous faith? Jones completely ignores the vast amount of faith-based belief that characterize evolutionists. For instance, evolutionists are unwavering in their belief that life came about from non-intelligent interactions of lifeless chemicals, even though there is not a shred of evidence to support it. In fact, it has sagely been said that it takes more faith to believe that life arose spontaneously from nonliving chemicals than it takes to believe that life arose from the deeds of an Intelligent Designer.

Consistent hostility to religion

Jones claims that his book is neither a defence of, nor attack on, religion (p. 5). His posturing is laughable. Throughout this volume, Jones repeatedly displays an unmistakable antagonism towards religion, some of which has already been discussed. He unquestioningly accepts the JEPD hypothesis for the authorship of the Pentateuch (p. 245) and uses the BCE/CE system in place of BC/AD (p. 31). (The BCE/CE system, originally employed by non-Christian Jews, and some others, was first used on a large scale under Communism. It is nowadays widely used by non-Christians and especially by academics, who thereby try to delegitimize Christianity's role in Western thought and history.)

The author repeats standard jibes against religion, such as the "empty logic" of considering the heavens as declaring the handiwork of the Lord (p. 3), of the Old Testament God being an "implacable god" (p. 7), of the church's (alleged) proneness to use the stake to burn religious dissenters (p. 105), of the face of Jesus Christ seen by some of the devout in tomatoes (p. 16), and other inanities. To crown the insults, he calls American fundamentalist preachers embezzlers (p. 405). He imagines that demonic possession is merely insanity (p. 360), and repeats the old saw that Saul's conversion experience to Paul was an epileptic fit (p. 361). He dismisses believers in religious visions as engaging in "the sleep of reason" (p. 347).

Most offensive of all is Jones' characterization of the evolution of sex as a means of "rejuvenating" the expression of the DNA molecule. He vulgarizes this as a type of born-again process, comparable to the biblical born-again process of people experiencing salvation, and cleansing, through Jesus Christ (pp. 163–164).

Are secular nations 'superior'?

Jones makes a variety of unsupported assertions on the sociological aspects of religion. He claims that religious nations have more crime, more mental illness, and less social mobility than more secular ones (p. 403). As anyone with a modicum of common sense knows, there are many factors that influence the major trends in modern societies.

Perhaps less stable and less prosperous nations *are* generally more religious than more stable and more prosperous nations. The actual explanation is prosaic. Since humans are naturally sinful, and sin is so insidious, it is easier to deny sin and be comfortable with one's sinfulness in an environment that facilitates complacency, self-sufficiency, and a perceived lack of need for God, at least for material things.

Jones brings up Sweden and Finland as models of nations that are very secular, yet superior to devout nations in dealing with crime, illness, etc. (pp. 417–418). His comment is beyond ridiculous. Finland and Sweden are small nations that are

very ethnically homogenous. Why, then, should the low crime rate be a surprise? As for the social services of these nations, the efficacy of the economies of these nations is a debatable matter.

The author summarizes what he thinks is the modern irrelevance of religion. He makes the following patronizing remarks:

> "Whether religion was invented as a means of social control or as an attempt to increase stability now means little, for in the West at least God's work has been replaced by that of Man. The decline of faith shows how peace, contentment and prosperity have come to depend more on human actions than on those of some imagined deity" (p. 418).

The Bible warns us time and time again that riches do not last. Considering all the prosperous and powerful nations of the past that have fallen, and the great evils that humans have shown themselves capable of, Jones' flippant remarks seem to partake of the height of hubris. He also wilfully forgets about the megademocides (millions of people murdered by their government) of the aggressively secular communist nations last century.

The big bang—a lesson for Hugh Ross

Christian astrophysicist and well-known speaker Hugh Ross goes around attacking biblical ('young earth') creationists, proclaiming the big bang as a reconciliation of God and evolution, and something that makes God respectable in the eyes of most scientists. In a stinging implicit rebuke to Ross, Steve Jones makes it obvious that dragging God into the big bang does not impress atheists in the least.

More fundamentally, Jones makes it clear that most scientists find no more value in a God-involved big bang than they would in a recent, six-day divine fiat creation. He comments:

> "What sparked off the Bang is a mystery. For believers, God did it; but to most scientists that statement is not an answer but an excuse. As those who study the skies struggle to fit mathematics to reality, some of their suggestions are almost beyond comprehension" (pp. 64–65).

In other words, any idea—no matter how woolly—will be entertained, except, of course, God.

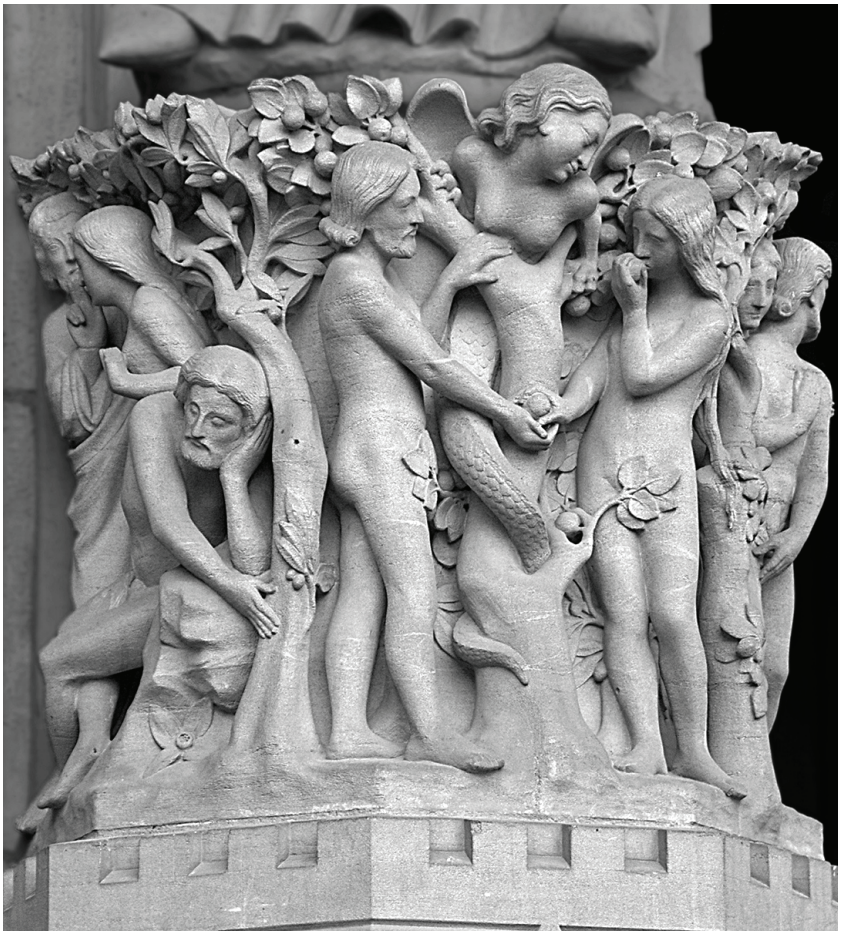


Figure 1. The serpent promised wisdom when he tempted Eve. The author appropriates this by changing it to a different kind of wisdom.

A healthy dose of evolutionary storytelling

There is nothing unusual about evolutionists confusing their storytelling, about inferred evolutionary events, with science. However, author Steve Jones takes this storytelling to new levels. Perhaps this is not surprising, as he is hailed by *The Independent*, a leading UK paper, as a "master storyteller". As an example, Jones conceptualizes the role of continental drift on the imagined origin of life. He comments:

> "Life itself was born in the ruins of such a slow geological car-crash. The uneasy movements of the newborn planet provided many of its ingredients for as the ground churned it dug up minerals from the depths. They were washed away by the rain to make a fecund chemical broth, the fare of the first organisms" (p. 69).

And everyone lived happily ever after.

Figure 2. The appearance of the Holy Spirit before Teresa of Avila. Not surprisingly, author Steve Jones is dismissive towards such mystical experiences.

Scientism and evolutionistic triumphalism, not science

The author has a pronounced 'science has facts and religion has faith' mentality. Jones has a burlesqued view of religion. To him, it is a set of unquestioned, non-factual, superstitious beliefs. Science, in contrast, is based on evidence, and even the reluctant scientist may have to admit that his theory was wrong (p. 15).

In common with many evolutionists, Jones speaks out of both corners of his mouth. On one hand, he exults science, unlike religion, as non-dogmatic. On the other hand, he engages in heavy-duty dogmatism (not to mention intellectual arrogance) as he summarily despises those who "deny the truth of evolution" and those who "reject the notion of man-made climate change because they do not like the idea. I find such ideas impossible to understand" (p. 17). It certainly looks as though Jones cannot grasp the fact that intelligent people, including scientists, can legitimately disagree with him.

Ironically, the foregoing creates a conflict for the author. Jones does not know how to deal with prominent Australian atheist Ian Plimer. On one hand, Jones praises Plimer for attacking the account of Noah's Ark but then expresses disdain for Plimer questioning man-made global warming! (p. 230).

Dubious to tenuous analogies with Scripture

As part of his fast-and-loose story-telling, Jones cites the Bible when it serves his purposes. He finds a parallel between conventional evolutionary and biblical themes, no matter how far-fetched. He 'steals' events in the Bible and refashions them according to his ideas.

Thus, to Jones, the drifting continents are "arks" that parallel Noah's Ark (p. 68). The founder effect, in evolutionary theory, is supposed to be comparable to the founders in the Bible (e.g. Noah's family) (p. 255). The debate, between Calvinists and non-Calvinists, on free will versus predestination, is supposed to be comparable to the modern debate about free will and determinism in human behaviour (p. 104).

Much about little

Whether or not he refers to the Bible, author Steve Jones meanders from topic to topic. He jumps around to matters as diverse as ancestry and kinship, ancient Judaism, human life expectancy, sensory and hallucinatory experiences, chimpanzees, climatic change, the DNA molecule, food and diet allergies, health and disease, mystical experiences, human population trends, the biology of sex, and human starvation (of course, the worst example was the genocidal *Holodomór*, 'extermination by starvation', where millions of Ukrainians and non-Ukrainians, including Poles, were starved to death under his fellow atheist, Stalin). All of these, and more, he covers in a centimetre-deep, kilometre-wide manner.

Conclusions

This book is a disappointment for several reasons. Its content is quite disjointed, and it is unlikely to hold the interest of the reader. It presents all the evolutionary dogmas as fact while, ironically, excoriating religion for being dogmatic.

The author offers nothing new. When not finding imaginary parallels between Scripture and modern thinking, Jones simply repeats many of the time-worn attacks on religion, especially Christianity.

References

1. Stark, R., *How the West was won*, ISI Books, Wilmington, DE, 2014.

Nylon-eating bacteria

Royal Truman's detailed introduction to the subject of whether or not nylon-eating bacteria demonstrate macroevolution in issue 29(1) is a welcome contribution, interesting, and insightful. It adds important weight to the argument that evolution hinders rather than helps scientific understanding.

I suggest we be skeptical whenever anyone claims that some man-made chemical is 'unnatural' and that microbes have never been exposed to it before. It may be true, but the number of organic substances produced by living organisms seems at present to be endless—the more we look the more we find. And all of them can be degraded by microbes of various kinds, otherwise they would build up into commercially exploitable deposits. Peat bogs, for example, are commercially exploitable biological deposits, but they are not the result of microbial failure. They result from an imbalance in the rate of production over degradation, usually caused by high water tables and low temperatures.

The following types of chemicals were quoted by Truman as having been dubbed 'unnatural substances' but just some of their naturally occurring sources are easily found with an internet search and are listed here in brackets: *toluene* (pine trees, *Myroxylon balsamum* a leguminous tree); *camphor* (camphor laurel and related trees, rosemary, basil); *salicylate* (willow tree bark, unripe fruits/vegetables, herbs, spices, nuts); *alkanes* (crude oil, plants, animals, fungi, bacteria); and, *naphthalene* (tar pits, magnolia, deer, termites, fungi, meteorites).

Earth's biosphere is built upon three diverse kinds of living organisms—producers, consumers, and recyclers. Ecology is the study of their interactions and the *Journal of Chemical Ecology* has been documenting chemical aspects of these interactions for over 40 years. One notable class of such interactions is the chemical warfare that goes on between producers and consumers. Plants constitute a large component of the 'producer' category and they cannot run away to protect themselves like animal consumers do. So they mount a variety of chemical attacks to limit the damage caused by consumers. In response, consumers must develop strategies to overcome these chemicals and so there is an ongoing 'arms race' consisting of attack and counter-attack. One example is *Leucaena leucocephala*, a leguminous tree native to Central America that was widely planted for stock feed throughout the world because of its rapid growth rate and high nutritive value. In some countries, however, it proved toxic. The problem turned out to be a lack of the naturally occurring gut bacterium *Synergistes jonesii* which broke down the toxic component.[1] By inoculating herds in those countries with cultured *Synergistes jonesii* the problem was solved, although ongoing exposure to *Leucaena* was required to maintain bacterial vigour.[2]

A chemical arms race also occurs in host-parasite relationships. It is sometimes referred to as the *Red Queen effect*, recalling Alice's experience of *Looking Glass* land where the Red Queen says: "Now, *here*, you see, it takes all the running you can do, to keep in the same place."

Apart from the host of organic substances produced by earth's myriad species there is yet another much larger catalogue of organic chemicals in the natural environment—intermediate breakdown products. They are everywhere. The onus of proof is clearly upon evolutionists when it comes to claims that man-made chemicals (or close analogues of them) do not exist in nature.

Another truly new insight into the capabilities of living organisms was recently presented by Andreas Wagner in his book *Arrival of the Fittest: Solving evolution's greatest puzzle*, reviewed in issue 29(1) by John Woodmorappe. Woodmorappe is to be congratulated for translating Wagner's major claims into everyday analogies which demonstrate that he claims far more than he delivers. In fact, the use of analogies is so fundamental to human thought, learning and understanding, that I highly recommend Hofstadter and Sander's book *Surfaces and Essences: Analogy as the fuel and fire of thinking*. But Woodmorappe said in the introduction that he would not be assessing the detail of the book and it is this which is relevant to nylon-eating bacteria. Wagner and his team are experts in network theory and their theoretical breakthroughs are quite breathtaking. He demonstrates, through examples in metabolic networks, gene regulatory networks, and amino acid sequence networks, that although there are more ways of being dead than alive there are still 'hyperastronomical' numbers of innovations that organisms can make just by taking one non-lethal random step at a time.

I will not try to explain or defend the credibility of these claims, but the examples and the principles involved seem to be sound. The upshot is that once such complex networks are in place they are capable of changing in mind-numbingly different ways in very short hops. Especially among bacteria where large numbers of individuals can explore the many dead ends (literally) without serious risk of population extinction, while a still-large number of other individuals with non-lethal small changes can move on to explore multitudinous new futures. Life can do it. It's not hard, apparently. But it should bring little comfort to

thoughtful evolutionists because, like natural selection, Wagner's complex network behaviours do not even begin to function until the complex networks are *already in place*.

Meanwhile, the legwork of careful scientific investigation and validation remains to be done, and Truman's contributions are to be most warmly welcomed and encouraged.

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References

1. *Leucaena leucocephala* factsheet, www.tropicalforages.info/key/Forages/Media/Html/Leucaena_leucocephala.htm, accessed 8 April 2015.
2. Graham, S., Introduction, impact and retention of *Synergistes jonesii* in cattle herds grazing *Leucaena leucocephala*, MPhil Thesis, School of Agriculture and Food Sciences, The University of Queensland, 2010, espace.library.uq.edu.au/view/UQ:226061, acessed 8 April 2015.

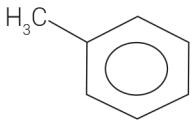
» Royal Truman replies:

Alex Williams has made many valuable contributions to creation science research and I always read his contributions in this journal with much interest. He makes some excellent points in his letter and I urge everyone to read again what he wrote.

It is correct that most synthetic substances or *close analogues* introduced by humans into the biosphere already existed and were being recycled naturally at least in small quantities, so existing mechanisms could usually be optimized. A unique contribution we can make to science is a paradigm switch to understanding both the big picture and fine details of biology. We assume a Creator was involved who intended to solve current and future problems effectively and we can formulate testable design-inspired hypotheses. To illustrate, a common computing or engineering strategy is to create distinct and configurable modules for classes of problems and these modules are then reused in computer programs and machines. Once enzymes exist somewhere in an interacting ecological system for molecules such as toluene (figure 1),[1] salicylates (e.g. aspirin in figure 2), and alkanes (e.g. figure 3), then the basic 'modules' are in place not only to recycle a vast number of similar molecules but also other substances which contain their key chemical features linked at various positions like the example shown in figure 4.[2]

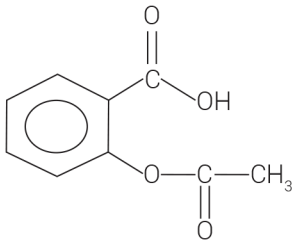
In a similar manner, it is probable that a large polymer of nylon or a polymeric side product did not exist having an identical structure in the past in nature. But biodegradable analogues which contain an amide bond certainly did, and sequential reuse of the same or a modified enzyme can break down the new polymers stepwise. This is usually a better design than requiring a unique enzyme for a unique molecule, with different portions responsible for processing different portions of the molecule.[3]

Conceptually armed with a design premise we can then ask the right questions to guide novel research efforts. Enzymes in the presence of energy-supplying ATP could also degrade valuable biomolecules needed by organisms, i.e. at the wrong time. How are these processes regulated? What would be sensible population sizes to provide an effective search algorithm, enhanced with mutations, to find solutions to ecological problems? What would the ideal trade-off be between microbial reproduction rates (to offer more search opportunities) vs the material, time and energy consumed to grow new members too often? How might a distribution of effort between different kinds of organisms be set up to optimize ecological problems being solved by coordinated efforts? (Gene transfers



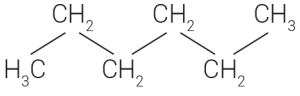
Toluene

Figure 1. Chemical structure of toluene



Acetylsalicylic Acid (asprin)

Figure 2. Chemical structure of acetylsalicylic acid (aspirin)



N-Hexane

Figure 3. Chemical structure of n-hexane, an alkane

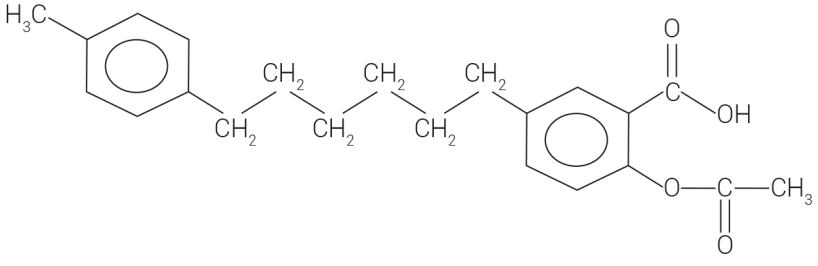


Figure 4. One of many possible chemicals which could contain the structures found in toluene, acetylsalicylic acid and alkanes

now make sense once the correct question is formulated. The guiding insight then becomes, how is this guided to determine what is transferred, effectively). What kinds of mutations would make sense (point mutations, frameshifts, multi-coding) and what rates would be most effective? If too fast and random, then highly effective enzymes requiring no change would deteriorate over many generations, but if too slow the solutions would offer little value when needed.

Many thanks again to Williams for the stimulating observations.

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References

1. Similar molecules could have additional functional groups attached.
2. How a final complex molecule like the one shown in figure 4 was synthesized by humans is irrelevant and I am not implying the molecules shown in figures 1–3 had to be used as raw materials.
3. Occasionally a multifunctional or multistep enzyme complex would make better design sense if the end product is needed quickly at that location. This kind of intelligent work organization is sometimes used in manufacturing wherein the sequential steps are handed over just in time to an adjacent workplace. This would make sense for a repetitive core biochemical process.

Trinity's truth reflected in creation

Ian Hodge's recent article entitled "Trinity's truth reflected in creation" was a pleasure to read.[1] The Bible-believing Christian's unique answer for one of the most fundamental philosophical problems, 'the One and the Many', is too little discussed and appreciated. Instead of Christian apologists being defensive regarding the difficult-to-grasp concept of the Trinity, we should be on the offence with the only coherent explanation for the simultaneous unity and individuality manifested in all mankind. Why do we all share similar hopes and ideals? Why do we unconsciously aspire towards the same ends? The answer is the fundamental unity within conscious life. But why do we pursue different means to the end and subscribe to a unique ethic along the way? Clearly there is also personal diversity. This dialectic is every human being's life experience. But the metaphysics of no other religion or philosophy can provide a satisfying explanation for this experience.

Yes, the idea of the Trinity is complex and beyond our finite ability to totally grasp. But why should we expect anything different with an infinite, omniscient Creator? The eminent Christian philosopher Francis Schaeffer made the remarkable statement, "I would still be an agnostic if there were no Trinity, because there would be no answers."[2] Speaking of Schaeffer, it would have been good for Hodge to have included a reference to his delightful little book in this regard. Schaeffer makes a great point that would have fit well in this article. If it were not for the Trinity, "we would have had a God who needed to create in order to love and communicate. In such a case, God would have needed the universe as much as the universe needed God".[3] So the Trinity is a necessary doctrine in our understanding of the independent and self-sufficient Creator at still another level.

Hodge references the unfortunate result of Islam's disproportionate emphasis on unity without a counterbalancing emphasis on diversity. But I think an even better example, one that would have been productive to explore, is Hinduism. Their monist schools hold to a view of a singular ultimate divine force behind everything, reducing their polytheism to a unified Brahman. Moreover, this reductionism in their pantheistic view escalates to the extreme of everyone eventually being absorbed into that singular force and losing their identity in a state of nirvana. The present perception of diversity, they claim, is only an illusion. The tragic result of this spiritual outlook can be seen in Hindu society's lacking compassionate care for destitute individuals and even whole classes of their own people. Not only is the concept of Christian charity absent, there is actually a belief that helping the unfortunate by relieving their misery hinders their progress in the cycles of reincarnation. If their pain results from bad karma in a previous life, then they must be allowed to pay the price so they can move towards Brahman.

When I discuss the philosophical necessity of a plurality in the Creator, there arises a common objection: if this is such an important and foundational concept, why is the Trinity not presented until the New Testament era? But this assumes that the patriarchs were ignorant to the concept of the Trinity; not necessarily a safe assumption at a time when God was personally conversing with men. I believe that the idea of a diversity within the Godhead is implicitly given in the Old Testament—all the way back in Genesis 1.[4] The profound statement "Let us make man in our image" is simultaneously a revelation of God's plurality of person (the pronoun 'us') and the explanation that humans (made in His image) would experience unity and diversity. Moreover, God's first revelation of Himself is *Elohim*, a plural form that is used in conjunction with a singular verb. If this were not enough, Hodge's article nicely explains how the idea can be gleaned from observing creation itself. Indeed all created reality, because it is created by the

Trinitarian God of the Bible, reflects His Being in terms of 'the One and the Many'.

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References

1. Hodge, I., Trinity's truth reflected in creation, *J. Creation* **29**(1):88–94, 2015.
2. Schaeffer, F., *He Is There and He Is Not Silent,* Tyndale House Publishers, Wheaton, IL, p. 14, 1972.
3. Schaeffer, ref. 2, pp. 15–16.
4. Some hold that Genesis 1 involves God speaking to angels (though there is no indication in Scripture that they were involved in creation) or a linguistic 'plural of majesty' (though we have no such use elsewhere by royalty).

Human genome decay and the origin of life

I question the claim that "Natural selection also plays a strong role in fertilization, ensuring that only the fittest one out of millions of sperm cells gets to fertilize the single egg that is produced in each reproductive cycle."[1] Not so: it is almost completely a matter of luck, based on the physical position of the 'successful' sperm in the ejaculate. Most of the movement of the sperm is by bulk flow or by ciliary propulsion in the fallopian tube. It is only in the last few millimetres that a sperm is 'on its own'. In addition, the mechanisms for rapid prevention of polyspermy do not depend on the relative fitness of an individual sperm. The sperms that are 'locked out' may be even more fit (whatever that means) than the lucky one that fertilized the ovum. Similarly, I know of no evidence that the female 'selects' which of her primary oocytes to retain during her embryogenesis. Since these assertions regarding gamete fitness figure into your models, they may affect their validity.

References

1. Williams, A., Human genome decay and the origin of life, *J. Creation* **28**(1):91–97, 2014.

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» Alexander Williams replies

I thank Richard Meiss for the feedback. I agree that chance is a big factor in conception. However, the passages you quoted came in the discussion and are not assumptions in the models so they do not affect the outcome. I mentioned natural selection only as a possible explanation for the very high copy fidelity.

Does the ovary play an active part in selecting the highest quality eggs when their numbers are dramatically reduced during ovary development? The recent discovery of a 'transcriptomic fingerprint' of egg quality suggests that it may do so.[1]

> "Sperm experience intense and varied selection." Ejaculation sends sperm into the vagina only. The cervix remains closed until ovulation. Sperm that survive hours or days of waiting in the acid environment of the vagina must then swim through the uterus and up the fallopian tube. The distance (not including waiting time) can be more than 5,000 body lengths—in human equivalent, think 200 laps of a 50m swimming pool. Sperm must be prepared over several hours by mechanisms supplied by the female.[2]

"[E]vidence from biochemical, molecular and genetic studies [indicate] that the female reproductive tract can read and interpret a spermatozoon's 'molecular passport' or genetic signature" and select not only for fertilizing ability but also genetic suitability for that particular female.[3] If the female can select which sperm she wants on the basis of its 'molecular passport' then it seems reasonable to infer that she can also select developing eggs on the basis of their 'transcriptomic fingerprint'.

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References

1. Chapman, R.W., Reading, B.J. and Sulliva, C.V., Ovary transcriptome profiling via artificial intelligence reveals a transcriptomic fingerprint predicting egg quality in striped bass, *Morone saxatilis*, *PLoS ONE* **9**(5):e96818, 12 May 2014 | doi: 10.1073/pnas.0631609100.
2. See: youtube.com/watch?v=BFrVmDgh4v4).
3. Holt, W.V. and Fazeli, A., Do sperm possess a molecular passport? Mechanistic insights into sperm selection in the female reproductive tract, *Molecular Human Reproduction* **21**(6):491–501, 2015 | doi: 10.1093/molehr/gav012.

Examining the floating forest hypothesis: a geological perspective

Timothy L. Clarey

The hypothesis of a pre-Flood floating forest biome has been in the creation literature for several decades. The idea was developed as an explanation for the massive coal beds found in Carboniferous rocks globally and was based primarily on paleontological analysis. Surprisingly, this hypothesis was never adequately tested against other geological data. This paper presents three challenges, from a geological perspective, that draw into question the validity of the floating forest hypothesis. First, floating forests are found incapable of maintaining a sizable freshwater lens to supply the plant life, pools, and springs as suggested. Second, tsunami-like waves associated with plate movements would have likely broken up the floating biome earlier in the Flood than suggested, depositing coal beds throughout much of the stratigraphic column, contradicting the rock record. Third, relatively few coal beds are found as a result of the closure of the Iapetus Ocean ('proto-Atlantic') early in the Flood as Rodinia began to fragment. It is not until after this pre-Flood ocean was completely consumed that we find extensive coal beds deposited on the adjacent continents. When examined against available geological data, the floating forest hypothesis is found to lack explanatory ability. Instead, a return to studies of pre-Flood paleogeography and plant zonation to explain the coal beds is suggested.

One of the problems many creationists struggle with is the fossil record, and in particular, explaining the order of the fossils in Flood sediments. Secular paleontologists have used the order of fossils, generally from older marine organisms to younger terrestrial organisms, to advocate their theory of evolution, concluding that life evolved from marine organisms. In fact, land plants do appear in Flood rocks stratigraphically above the first appearance of marine organisms, but this does not demonstrate that evolution has occurred.

One rather novel approach to explain this pattern has been the hypothesis of a floating forest, advocated by Wise.[1,2] The beginning of this concept goes back even further to the work of Scheven.[3,4] Many other authors have subsequently written in support of the floating forest hypothesis, primarily focusing on the lycopod hollow root system[5–8] (figure 1). These authors conclude that huge, subcontinent- to continent-sized, floating forest biomes existed in the pre-Flood world along the continental margins and across the open ocean[1] (figure 2). The proposed massive mats of diverse plant life are envisioned to have later broken up during the Flood event, becoming deposited as globally extensive Carboniferous coal beds.[1] Wise has also suggested that these mats contained their own unique fish and animal fauna, and may have even trapped fresh water atop the mat in a perched freshwater lens with pools and even freshwater springs above the ocean surface.[1]

While the floating forest is a unique concept, and is a creative attempt to explain the order of the plants and animals in the fossil record, it has not been adequately scrutinized against the observed geological record. This paper examines the floating forest hypothesis using three geological criteria in an attempt to assess its validity.

Trapping a freshwater lens

Water flow through a 'floating forest island' is likely similar to flow through an unconfined aquifer in a modern island setting. In marine islands, groundwater flowlines travel away from the centre, the highest point, where water pressure is highest, and toward discharge points along the island edge at the freshwater / ocean water interface.[9]

The water table (the boundary between the unsaturated and saturated zones), and any freshwater lens is recharged by precipitation that infiltrates downward, under the influence of gravity, through pores in the unsaturated zone, causing the water table to rise.[9] Water in the saturated zone can actually flow upward due to differences in hydraulic head pressure. Recurring precipitation is the primary method for the creation and the maintenance of an 'island' style freshwater lens atop salt water. Without sufficient rainfall, the water table flattens and the freshwater lens thins to zero.

Contrary to what has been suggested,[10] the capillary fringe plays a minimal role in the creation of a freshwater lens. Capillary action is not technically part of the saturated zone but instead occurs on top of the water table, 'wicking' up some water into the vadose zone (unsaturated zone).[9] While it is true that the thickness of a capillary fringe is greatest in fine sediments, the pressure head is still negative,

indicating that the fringe is still unsaturated and not part of the water table (freshwater lens) beneath.[9]

My first goal was to determine whether a floating lycopod forest could create and sustain an adequate freshwater lens to supply the plants, and presumably the animals. I assumed that the floating mat of tangled lycopod forest roots and plants described by Woolley[6] and Scheven[4] approximated a porous medium. The governing equation that defines flow through a porous medium is Darcy's Law.[9] Average linear velocity of flow can also be approximated using a derivation of Darcy's Law:[9]

$$V = -KG/n_e$$

V = Average Linear Velocity (cm/sec)
K = Hydraulic Conductivity or Permeability (cm/sec)
G = Hydraulic Gradient
n_e = Effective Porosity.

I then had to assume a hydraulic conductivity (or permeability) for tangled roots and a plant raft, with a rhizome-based anatomy and lycopod root system (figure 2). As this environment does not exist today, I used the hydraulic conductivity for woody peat, which ranges from $K = 10^{-1}$ to 10^{-4} cm/sec,[11] which is similar to the hydraulic conductivity in the upper range of silty sands ($K = 10^{-3}$ to 10^{-5} cm/sec).[9] Peats that are derived from reed and sedge plants have a slightly lower hydraulic conductivity range,[11] with values down to 10^{-6} cm/sec. However, Holden[12] found values for hydraulic conductivity in the vadose zone peat layer between $K = 10^{0}$ and 10^{-4} cm/sec, and Pitcher and Hession[13] conducted slug tests on the upper peat beds of a kettle bog, finding values between $K = 10^{-3}$ and 10^{-4} cm/sec. For my calculations, I chose a hydraulic conductivity value within the range of these values, settling on $K = 1 \times 10^{-3}$ cm/sec, which seemed a very reasonable approximation of the floating forest permeability. Finally, I assumed an effective porosity between silt and sand and gravel of 35% and a modest gradient or hydraulic pressure head of 0.5 cm/100 cm, or 0.005.[9]

The resulting linear velocity was determined as $V = 1.4 \times 10^{-5}$ cm/sec. Knowing that 1 cm/sec = 864 m/day,[9] this velocity was converted to V = 0.012 m/day, or over 1 cm/day. This is likely a minimum velocity. A realistic value could be 5–10 times greater in the lycopod root system described by Woolley,[5–7] assuming a slightly higher permeability. Higher gradients would also only increase the velocity. These seepage velocities are far too large to sustain freshwater ponds, springs and even much of a perched freshwater lens as proposed,[1] without continual precipitation. Water would merely flow through the root system and discharge into the ocean, making a sizable freshwater lens problematic.

Finally, what is the source of this freshwater influx? Many creationists assume there was little rainfall before the Flood (Gen. 2:5), or at most only slight rainfall events (mists?), or infrequent, non-violent rainfall events. It seems likely that the pre-Flood world did not provide sufficient rainfall to sustain a floating forest biome. Without being attached directly to land, which could provide a source of hydrologic groundwater flow, a floating mat fails to hold water.

But, let's assume there was sufficient rainfall in the pre-Flood world to sustain a significant freshwater lens within the proposed floating forest biome. This also assumes any storms bringing precipitation were not very severe or they would have produced strong winds and waves to break up the floating mat from the outside edges inward. Also, we must assume ocean currents were in operation before the Flood to prevent stagnant ocean water at depth. Without ocean currents, there would be only limited upwelling and downwelling occurring in the open ocean. Vertical transport of ocean water is necessary to bring nutrients upward to the surface for plant growth and to transport oxygen downward for animal sustainability at depth.[14]

Pre-Flood currents circulating around the margins of the oceans would likely create gyres. Ocean gyres move surface water to the centres of the oceans, as is observed today, due to geostrophic flow caused by the Ekman spiral.[14] Surface convergence in the centre of the ocean gyres produces a broad mound of water about 2 m high, which is relatively high in salinity and supports little life.[15] Likewise, these conditions produce downwelling beneath the area of surface convergence, and, presumably, would have done likewise beneath the continent-sized floating forests, contrary to earlier claims.[10] Downwelling produces surface waters with low productivity,[15] presumably inhibiting the postulated floating forest biome.

Deposition of three megasequences beneath the forests

Second, I examined the level in the Flood record where we see the 'floating forest' coals. The rocks that contain the bulk of the proposed biome fossils are within the Carboniferous system, specifically the Pennsylvanian system or the Upper Carboniferous. This places the burial of the vast majority of the floating forest biome near the base of the fourth megasequence, or Absaroka Megasequence,[16] as defined for the North American craton.[17] Therefore, this requires the deposition of three complete megasequence cycles in North America beneath the floating forests, and all prior to their sudden and rapid burial in the Pennsylvanian system rocks of the Absaroka Megasequence. The amount of sediment

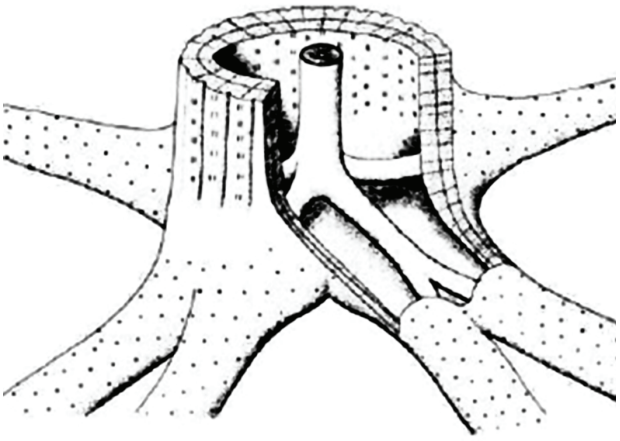

Figure 1. Reconstruction of a lycopod tree stump. Used with permission of *Journal of Creation*.[4]

deposited as part of these three earlier megasequences is tremendous. Upwards of 3 km of virtually coal-free sediment (and in some places over 6 km) was deposited along the entire US Eastern seaboard prior to deposition of the Upper Carboniferous (Pennsylvanian system) coal-rich beds (figure 3).[18] How did the forests remain intact atop the sea while all this deposition was occurring beneath? It seems highly unlikely that they floated as an essentially intact log mat for three megasequence cycles, and were then suddenly buried completely in the fourth (Absaroka) megasequence. Why not as part of an earlier continent-wide megasequence?

If, as some creationists have proposed,[19,20] the various megasequences were caused by plate movements during the Flood, then there would likely have been huge tsunami-like waves tearing apart the floating forests from the very onset. Tsunami waves observed today surge toward land and sometimes rise tens of metres upward nearest the shore as the water in front slows from friction against the sea floor, while continuing to build and accumulate from faster water waves behind. They do not create a simple breaking wave, but a massive mound of water, more like a fast-moving tide than a wind-driven wave.[14] Tsunamis approaching shore produce waves that are much larger on the landward side. The resulting surge of water can easily race across low-lying terrain, shearing trees and plants off in its path.[14]

During the Flood, it can be assumed these waves were even greater than what has been observed in the recent past, transporting sediment and water (which would include the floating forests) 100s of kilometres inward. Evidence for mass transport of water and sediment during the Flood is illustrated by the basal Sauk Megasequence map, showing the Tapeats and equivalent sandstone, covering a major part of the North American continent.[21]

It seems likely that the very first North American megasequence cycle, the Sauk,[17] would have broken up the floating lycopod forest right from the start. This would have deposited coals in Cambrian system rocks, contradicting the fossil record. It is not until the second North American megasequence, or the Tippecanoe,[17] that the rocks show the first appearance of any terrestrial plants, and only a very limited amount.[22] During the deposition of the third megasequence, the Kaskaskia,[17] we find larger numbers of terrestrial plants and limited thin coal beds.[22] But it is not until the start of the fourth megasequence, in the Upper Carboniferous, that we find extensive coal beds filled with the bulk of the proposed floating forest plants.[1,22]

Snelling has used the floating forest model to explain coal cyclothem deposits in the Paleozoic.[23] He suggested that the main cores of the floating forest biome were destroyed early in the Flood, but did not give a specific timeframe, resulting in toppled lycopod trees that floated temporarily on the surface. He proposed that as the floating debris and logs became progressively water-logged, sinking a few at a time,

Figure 2. Diagrammatic representation of a floating forest. Used with permission of *Answers Magazine*[2]

they became thin coal beds within the sedimentary deposits beneath. This gradual process, he suggested, explained the repetitive nature of later Paleozoic coal and marine sediments called cyclothems.

However, no explanation was given to justify why the bulk of the 'floating' debris mats became water-logged and buried nearly simultaneously in just one system (Pennsylvanian) and within only the fourth North American megasequence (Absaroka).[23] Again, the floating forest hypothesis fails to address the lack of significant coal deposits in the first three, continent-encompassing, megasequence cycles. The rapid plate movements responsible for the first megasequences (Sauk and Tippecanoe) would likely have produced tsunami-like waves right from the onset, destroying the core of the floating forests early in the Flood, as mentioned above. This would have resulted in deposition of water-logged debris and 'cyclothems' throughout a greater span of the rock record, starting with the earliest megasequences and possibly even into later Flood rocks, contrary to the observable fossil record. At the very least, it is unlikely that this process would have deposited most of the lycopod logs within one narrow mid-Flood episode as the rock record clearly indicates.[22]

Alternatively, Paleozoic coals and cyclothems may be simply a consequence of multiple tsunami waves washing across progressively higher levels of land as sea level rose during the Flood. During the deposition of the Absaroka Megasequence, the water levels may have reached the bulk of the pre-Flood lycopod forests and its associated animals. This would have torn free massive amounts of plant debris and nearly simultaneously deposited the forests with sediments in rapid succession as tsunami-like waves 'broke' onto the continental interior—a process more similar to the allochthonous origin of coal described by Austin.[24]

Missing forests of the proto-Atlantic

Third, I tested the hypothesis in a plate tectonic scenario using a segment of the pre-Flood ocean that was presumably destroyed early in the Flood. Catastrophic Plate Tectonics (CPT) has been proposed as playing a major role in Flood initiation.[20,23] Plate movement is envisioned to have begun with the break-up of Rodinia and the formation of the supercontinent Pangaea early in the Flood.[20]

According to secular geologists, and many creation geologists who advocate CPT, there was a pre-Flood ocean along the East Coast of the US called the Iapetus Ocean, separating North America from Baltica (another continental mass).[22] Early in the Flood, ocean lithosphere began to be consumed by runaway subduction along the US East coast, marked by the Taconic orogeny, while Ordovician system rocks (Tippecanoe Megasequence) were being deposited (table 1). The destruction of the Iapetus Ocean presumably continued through the Caledonian and Acadian orogenies as Laurentia (North America) collided with Baltica and Avalonia, finally placing continental crust against continental crust from Newfoundland to Pennsylvania. This three-part process completely consumed the Iapetus Ocean lithosphere by the time Upper Devonian system rocks

Table 1. Sequence of events along eastern North America during the early Flood

Strata/Megasequence	Location	Interpreted Tectonism	Flood Interpretation
Neoproterozoic to Cambrian	East coast of USA	Open Iapetus Ocean	Pre-Flood Iapetus Ocean
Cambrian to Middle Ordovician Sauk Megasequence	Eastern USA	Initial subduction of Iapetus Ocean	Early Flood runaway subduction consuming ocean lithosphere of Iapetus Ocean
Upper Ordovician Tippecanoe Megasequence	NE USA and Canada	Taconic phase/collision with Baltica	Early Flood runaway subduction consuming ocean lithosphere of Iapetus Ocean
Silurian and Lower Devonian Tippecanoe and Kaskaskia Megasequences	Eastern USA	Acadian and Caledonian phase; N. America collided with Baltica and Avalonia; Iapetus Ocean consumed	
Devonian Kaskaskia Megasequence	SE USA	Continued closing of southern Iapetus Ocean	Complete closing of Iapetus Ocean
Mississippian (Lower Carboniferous) Kaskaskia Megasequence	NE USA	Initial collision of Laurasia with Galatian Superterrane and Gondwana	Closing of Rheic Ocean
Pennsylvanian (Upper Carboniferous) through Permian, extensive coal Absaroka Megasequence	Eastern USA	Hercynian–Alleghenian phase; Appalachian Mountains resulting from a collision between North America and Africa. Formation of Pangaea	Floating logs get buried, and later turn to coal

were deposited (Kaskaskia).[22] Later, during deposition of the Mississippian system rocks (Lower Carboniferous), Laurasia (including North America) again collided with the Galatian Superterrane and Gondwana as part of the Hercynian–Alleghenian orogeny, completing the destruction of another segment of ocean (Rheic Ocean) lithosphere, and the formation of Pangaea.[22,25]

This scenario suggests that at least two significant segments of the pre-Flood ocean were completely destroyed through subduction, to the point of placing continent against continent, and all prior to the deposition of the most significant coal deposits (table 1). What happened to the presumed floating forests in these oceans? How did they escape deposition during runaway subduction and consumption of these pre-Flood oceans? There should be massive coal seams as evidence of their demise in eastern North America within the Tippecanoe and Kaskaskia Megasequences. However, it is not until later in the Flood, during the deposition of the next system (Pennsylvanian), part of the next megasequence (Absaroka), that we see the bulk of the coal deposited in eastern North America.[22] The floating forest hypothesis fails to adequately explain the lack of any massive coal beds at the time the oceans were destroyed, and cannot explain why the bulk of the lycopod forests were deposted en masse as part of the Pennsylvanian system. The proposed floating forests seem to have become phantom forests.

Instead, the lycopod coal beds were possibly deposited in a scenario more like the floating log mat model put forth by Austin,[24] where the plant material was ripped free from the land as the floodwaters rose, transporting and depositing the logs as part of the Absaroka Megasequence (Pennsylvanian system).[16,19] In this scenario, the closing of pre-Flood ocean segments would have had little influence on the timing of deposition of lycopod coal beds.

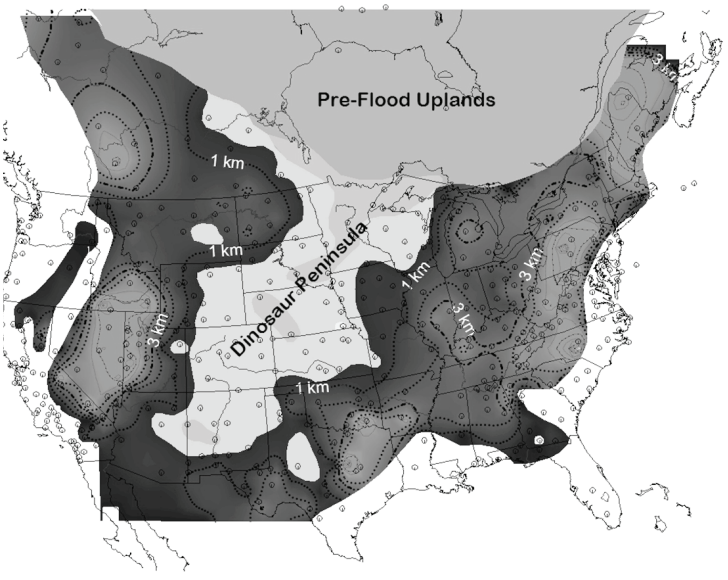

Figure 3. Pre-Flood map of the continental USA showing the proposed dinosaur peninsula trending NE-SW. Numbers shown represent the combined thicknesses of the Sauk, Tippecanoe and Kaskaskia Megasequences, all deposited prior to most major coal layers. Lycopod trees may have lived in shallow coastal areas fringing this low-lying land mass and became buried as the Flood waters advanced across the peninsula during the Absaroka Megasequence. Diagram courtesy of Davis J. Werner.

Other issues

In addition to these geological issues, I examined the plants involved in the presumed floating forests. Wise[1,2] and Scheven[3] have explained that the unique, hollow lycopod trees found in Carboniferous coal deposits would make perfect candidates for floating forests. Wise also interpreted the mixed terrestrial plants and animals encased within marine sediments as further evidence of the floating forest's existence in a pre-Flood marine realm.[1] But the mixing of terrestrial and marine organisms is insufficient evidence to conclude the existence of a floating forest biome because the mixing of these two environments is rather common in Flood sediments. Terrestrial coal fragments are found mixed with marine fossils in offshore sediments near Labrador (CAN), and dinosaurs in the Hell Creek Formation in Montana are encased with many marine fossils, including sharks and marine invertebrates.[26]

Advocates for this hypothesis also assert that many Carboniferous fossil plants became extinct because the pre-Flood floating forest biome no longer exists in the modern world. They have suggested that the 'choppy waters' of today's oceans would have prevented their re-formation after the Flood destroyed the original systems, causing the post-Flood extinction of the lycopod trees.[2,23] However, there are many extinct marine and terrestrial organisms, including brachiopods, trilobites, and dinosaurs, that are found only in Flood rocks. Post-Flood extinction cannot be used to argue for the existence of a floating forest biome any more than any other unique biome that might have existed in the pre-Flood world.

Finally, some of the same types of plants proposed for the floating forest, such as club mosses, horsetails and ferns, have extant versions that are identical to the fossil plants right down to the genus level, and/or are at least likely members of the same biblical kind. *Equisetum* is an extant horsetail that is very similar to *Calamites*, a horsetail that is found prominently in Carboniferous coals. Varieties of *Equisetum* are found primarily on land today, preferring wet, sandy soils with a few living in the semi-aquatic realm. Many of the fossil ferns found in Carboniferous sediments also have living descendants on land today, and many are possibly

the same biblical kinds. It seems more likely that these plants have always existed in the terrestrial realm where they are found thriving today. So, to argue that these same kinds of plants primarily existed in the pre-Flood world on a floating forest would seem to contradict the empirical evidence.

Conclusion

A reconsideration of the floating forest hypothesis is in order. When tested against the rock record and the presumed plate movements during the Flood, the hypothesis lacks explanatory power. It seemingly explains the paleontological record, when taken alone, but does not adequately explain other geological issues and the precise timing of coal deposition. There are alternative explanations for the observed fossil record. I suggest we turn our attention to studies of ecological zonation, pre-Flood geography, differential flotation, and hydrodynamic sorting of the pre-Flood plants to explain the coal deposits. Better development of pre-Flood geography will likely lead to a better understanding of pre-Flood biomes and better explain both the fossil and rock records.

Development of an alternative model that increases the height of the floodwater progressively, as indicated in Gen. 7:17–21, may be a place to start. Lycopod forests were possibly similar to cedar swamps and mangrove forests populating lowlands today. These unique flora may have filled the outer edges of the pre-Flood land masses, possibly in lagoons and/or in shallow waters, fringing the coast of areas like the proposed 'dinosaur peninsula' (figure 3).[18] The lycopod trees may have been simply torn loose and deposited *en masse* within the lower sedimentary strata of the Absaroka Megasequence as the floodwaters continued to rise.

This analysis finds no conflict with the flora and fauna found in a lycopod forest, only in the environmental setting. All geologic data support a 'grounded' lycopod forest that was growing attached to the pre-Flood land surface.

Acknowledgments

I thank Shaun Doyle for his editorial suggestions and ideas to improve this paper. I also thank several anonymous reviewers for their assistance and for help in constructing table 1. Finally, I thank ICR for their logistical and financial support.

References

1. Wise, K.P., The pre-Flood floating forest: A study in paleontological pattern recognition; in: Ivey, R.L. (Ed.), *Proceedings of the Fifth International Conference on Creationism*, Creation Science Fellowship, Pittsburgh, PA, pp. 371–381, 2003.
2. Wise, K.P., Sinking a floating forest, *Answers* **3**(4):40–45, 2008.
3. Scheven, J., Floating forests on firm grounds, *Biblical Creation* **3**(9): 36–43, 1981.
4. Scheven, J., The Carboniferous floating forest—An extinct pre-Flood ecosystem, *J. Creation (CEN Tech. J.)* **10**(1):70–81, 1996.
5. Woolley, J.F., The origin of the Carboniferous coal measures—part 1: Lessons from history, *J. Creation* **24**(3):76–81, 2010.
6. Woolley, J.F., The origin of the Carboniferous coal measures—part 2: The logic of lycopod root structure, *J. Creation* **25**(1):69–76, 2011.
7. Woolley, J.F., The origin of the Carboniferous coal measures—part 3: A mathematical test of lycopod root structure, *J. Creation* **25**(3):74–78, 2011.
8. Wieland, C., Forests that grew on water, *Creation* **18**(1):20–24, 1995.
9. Fetter, C.W., *Applied Hydrogeology*, 3rd edn, Prentice Hall, Englewood Cliffs, NJ, 1994.
10. Bruce, W., The salinity of a floating forest, *J. Creation* **16**(3):95–97, 2002.
11. Damman, A.W.H. and French, T.W., The ecology of peat bogs of the glaciated Northeastern United States: A community profile, *U.S. Fish and Wildlife Service Biology Report* **85**(7.16):1–100, 1987.
12. Holden, J., Peatland hydrology and carbon release: Why small-scale process matters, *Philosophical Transactions of The Royal Society A* **363**: 2891–2913, 2005.
13. Pitcher, P.J. and Hession, W.C., Hydrologic investigations and monitoring of a Vermont Kettle Bog, 1–16, 2002, www.uvm.edu/~pbierman/classes/critwrite/2002/paula.pdf, accessed March 5, 2015.
14. Thurman, H.V. and Trujillo, A.P., *Introductory Oceanography*, 10th edn, Pearson/Prentice Hall, Upper Saddle River, NJ, 2004.
15. Garrison, T., *Oceanography*, 8th edn, Brooks/Cole Cengage Learning, Belmont, CA, 2013.
16. Blakey, R., Paleogeographic and paleotectonic maps—Use, construction, interpretation, and example, Rocky Mountain Association of Geologists Short Course, Denver, Colorado, 28 January 2010.
17. Sloss, L.L., Sequences in the cratonic interior of North America, *Geological Society of America Bulletin* **74**:93–114, 1963.
18. Clarey, T.L., Dinosaur fossils in late-Flood rocks, *Acts & Facts* **44**(2):16, 2015.
19. Snelling, A.A., Geological issues; in: Boyd, S.W. and Snelling, A.A. (Eds.), *Grappling with the Chronology of the Genesis Flood*, Master Books, New Forest, AR, pp. 77–110, 2014.
20. Snelling, A.A., Geophysical issues; in: Boyd, S.W. and Snelling, A.A. (Eds.), *Grappling with the Chronology of the Genesis Flood*, Master Books, New Forest, AR, pp. 111–144, 2014.
21. Morris, J.D., *The Global Flood*, Institute for Creation Research, Dallas, TX, 2012.
22. Wicander, R. and Monroe, J.S., *Historical Geology*, 7th edn, Brooks/Cole, Belmont, CA, 2013.
23. Snelling, A.A., *Earth's Catastrophic Past: Geology, Creation & the Flood*, vol. 2, Institute for Creation Research, Dallas, TX, 2009.
24. Austin, S.A., Depositional environment of the Kentucky No. 12 coal bed (Middle Pennsylvanian) of Western Kentucky, with special reference to the origin of coal lithotypes, Unpublished Ph.D. dissertation, Pennsylvania State University, State College, PA, 1979.
25. Stampfli, G.M., Hochard, C., Verard, C., Wilhem, C. and vonRaumer, J., The formation of Pangea, *Tectonophysics* **593**:1–19, 2013.
26. Archibald, J.D., *Dinosaur Extinction and the End of an Era*, Columbia University Press, New York, 1996.

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Jesus the Creator in the Gospel of John

Lita Cosner

Each of the Gospels presents us with a unique portrait of Jesus, so that when we look at them together, we get a fuller sense of who Jesus is than any individual one can give by itself. While all the Gospels teach the divinity of Christ, John gives us the clearest picture of what that meant for Jesus' life and ministry. He shows us that Jesus was the Creator of the universe, and that as Saviour He inaugurated the new creation which takes place in the hearts of believers, and which will culminate in the New Heavens and earth.

Jesus, the Word

The very beginning of John's Gospel is intended to evoke Genesis in the minds of his audience. The first words, ἐν ἀρχῇ (*en archē*), are identical to those in the Greek translation of Genesis (Genesis 1:1 LXX). He goes back further than Jesus' baptism, further than the virginal conception, to eternity past to explain who Jesus is and why He came. But before he introduces Him as Jesus, John tells us about the λόγος (*logos*)—the Word.

The first notable thing about the Word is that He existed in the beginning—before creation: "In the beginning was the Word." So John immediately attributes a divine attribute to Jesus—He is uncreated. But John immediately makes impossible the heresy of modalism (which denies the distinctness of the Persons of the Godhead) when he asserts, "and the Word was with God". The word 'with' (πρός, *pros*) indicates a very close relationship between the Word and God—it might be paraphrased, "The Word was face-to-face with God". Jesus constantly makes claims about the relationship between Himself and the Father: e.g. 5:19–24; 6:37–40; 10:30; and 14:28–31. Perhaps the most intimate picture of this relationship is revealed in Jesus' High Priestly Prayer in John 17.

The idea of God having a companion would not be totally alien to John's audience. By the first century, Aramaic paraphrases of Scripture called *Targums* spoke about the *memra* of God. Since Jews by that time had stopped saying God's covenant name, Yahweh, they used a number of other terms when the paraphrase called for it, and one of them was *memra*, the Aramaic word for 'word'. But the *memra* could also be an entity distinct from God who acted as His agent or messenger. For instance, in Psalm 33:6, "By the word of the Lord the heavens were made" and "the word of Yahweh" was actually translated as the *memra*; in other words, the *memra* became an agent of creation. However, "it does not denote a being in any way distinct from God. It is just a reverent way of referring to God himself."[1]

Wisdom in Proverbs was also said to be with God at creation and almost a co-creator (Proverbs 8). However, Wisdom is there presented clearly as the "first of his acts of old" (8:22), so she is clearly not a divine Person, as John presents Jesus. And while there was a great deal of Wisdom literature in John's day, John never explicitly refers to Jesus as Wisdom.

But it seems that the Scriptures themselves were John's major source, especially considering the repeated claim in his Gospel that the Scriptures testify to Christ. Carson states: "Whether this heritage was mediated to John by the Greek version of the Old Testament that many Christians used, or even by an Aramaic paraphrase (called a 'Targum'), the ultimate foundation for this choice of language cannot be in serious doubt."[2] In the Old Testament, there is some almost-personification of the Word of God with regard to creation (for instance in Psalm 33:6 cited above). And God's revelation always happens through words. For instance: "Then the Lord spoke to you out of the midst of the fire. You heard the sound of words, but saw no form; there was only a voice" (Deuteronomy 4:12). And John presents Jesus as the ultimate revelation of the Father: "Whoever has seen me has seen the Father" (John 15:24), so "the Word" is an ideal image for the One who is both co-Creator and the ultimate revelation of the Person and Nature of God.

If there is any remaining ambiguity about John's claims regarding the Word, he removes it with his next statement: καὶ θεὸς ἦν ὁ λόγος (*kai theos ēn ho logos*, and the Word was God). In wonderfully compact language, this communicates both that the Logos shares the being of God, while differentiating Him from the Father. Wallace argues for a qualitative understanding of *theos*, i.e. "the Word was divine",[3] by which he means *fully* divine, having the nature of God. While a common response to this is that there is a perfectly good Greek word for 'divine' (θεῖος *theios*) in Koine Greek,[4] it would hardly be the only 'synonym' that exists in the language. However, due to the downgrading of the word 'divine' in the English language, the translation "The Word was God" is probably still the best way to convey John's true meaning.

The Word as the agent of creation

Not only does the Word exist alongside God the Father and share fully in the Divine Being, He works alongside the Father to accomplish what only God can do: "All things were made through him" (John 1:3). The New Testament consistently uses careful language to indicate that the Father is the Creator, and He created *through* the Son—i.e. the Son is the *agent* of creation. "This way of putting it safeguards the truth that the Father is the source of all that is."[5] And John clarifies that Jesus acted in this way throughout the entire creation process: "and without him was not any thing made that was made." This also teaches that Jesus is *not* a created being, because He could not be an agent in His own creation!

Furthermore, ἐν αὐτῷ ζωὴ ἦν (*en autō zōē ēn*, in him was life). This claim is identical to what Jesus later claims in John 5:26: "For as the Father has life in himself, so he has granted the Son also to have life in himself." Mankind became a living being only after God placed the breath of life in him, but the Word is self-existent, and His life is said to be what enlightens men: "and that light was the life of men".

The Light that came into the world

John's next statement, "The light shines in the darkness" (1:5), recalls Genesis 1:3; light was the first of God's creations, whereas darkness is not a 'thing' in and of itself, but the *absence* of light. There are two possible ways to translate the next clause; either "and the darkness has not overcome it", as in the ESV, or "the darkness did not comprehend it", as the NKJV translates it. The latter translation fits the context of John being the witness to the light. Also, John elsewhere uses the word νικάω (*nikaō*) to speak about overcoming (John 16:33; 1 John 2:13, 14; 4:4; 5:4, 5).

John turns from the Word, or the Light, to talk about the witness to the Light, John the Baptist. If we think about it, it may seem odd that the Light needs a witness. The only person who needs a witness to light is someone who is blind, and that is precisely John's point. The Light came into the world, but the people to whom He came were blind. So they needed a witness, "that all might believe through him" (1:7).

But most people did not believe: "The true light, which gives light to everyone, was coming into the world. He was in the world, and the world was made through him, yet the world did not know him. He came to his own, and his own people did not receive him" (1:11). We see examples of this rejection and non-recognition throughout John's Gospel, culminating in the crucifixion. However, John makes it clear that this rejection was not universal: "But to all who did receive him, who believed in his name, he gave the right to become children of God" (1:12).

The Word who reveals the Father

John returns to the *logos* imagery: "And the Word became flesh and dwelt among us, and we have seen his glory, glory as of the only Son from the Father" (1:14). The Word who was the agent for the creation of all things entered into His own creation. And just as He brought the universe into being in v. 3, He brought grace and truth into being in v. 17. The same Greek word, γίνομαι (*ginomai*), meaning to 'become' or 'come into being', is used in both v. 3 and 17, as well as 14, "became flesh".

The word "only" is the Greek μονογενής (*monogenēs*). The KJV translates this word "only begotten", following the Latin *unigenitus*, with the presumed derivation from μόνος (*monos*), meaning 'alone' or 'only'; and γεννάω (*gennaō*), 'to beget'. However, this does not fit the NT usage, e.g. Hebrews 11:17 refers to Isaac as Abraham's 'only begotten (*monogenēs*) son', yet we know that Abraham begat other sons (Ishmael, and by Keturah). Rather, *monogenēs* is derived from γένος (*genos*), which means 'kind' (compare: 'according to kind' in Genesis 1 (LXX) is κατὰ γένος (*kata genos*)). Thus *monogenēs* means 'only one of a kind' or 'unique'. Thus Isaac was the *unique* son of Abraham through whom the Abrahamic Covenant came. And Jesus is the *unique* son of God.

The greatest claim about Jesus comes in v. 18: "No one has ever seen God; the only God, who is at the Father's side, he has made him known". John called Jesus *theos* in v. 1, and *monogenes* in v. 14; now He puts them together. The phrase "the unique God who is at the Father's side" also expresses the same idea of verse 1: Jesus is God, but distinct from the Father and in a close relationship with Him. Even though no one has ever seen the Father, Jesus reveals Him. This idea is brought out even more strongly in John 14:8–9.

Many places in the Old Testament feature people who see a vision of God, or the angel of the Lord. So how can John say that "no one has ever seen God?" He gives us a hint in 12:41: "Isaiah said these things because he saw his glory and spoke of him". But the Being Isaiah saw was called *Adonai* (Isaiah 6:1) and *Yahweh* (6:3)—and John equates Him with Jesus. So we can draw the conclusion that John views theophanies from the Old Testament as visions of the pre-incarnate Son of God.

One week in the life of Jesus

Just as Genesis starts with a foundational week—the six days of creation followed by God's seventh-day rest—John also gives us a foundational week in the life of Jesus, culminating in the first of seven 'sign miracles'. This sort of detailed chronological detail is uncommon in John, so he probably did this on purpose.

On the first day, John the Baptist gives his testimony: he emphatically declares that he is not the Messiah, but instead the prophet preparing the way for the Messiah (1:19–28). On the second day, John identifies Jesus as the Messiah. On the third day, John testifies about Jesus to two of his disciples, who then leave John and follow Jesus (1:37). They spent the rest of the day with him (1:39), and the next day, Andrew introduced Peter to Jesus (1:40–42). On the fifth day, Jesus went to Galilee and called Philip and Nathanael. "On the third day" (2:1), inclusively counting, places the wedding in Cana and Jesus' first sign on the seventh day.[6]

Carson states:

> "This analysis is not grasping at straws. Only here does John provide a careful record of a sequence of days. ... The week of days climaxing in the miracle at Cana may provide an echo of creation-week (Gn. 1). That means the miracle itself takes place on the seventh day, the Sabbath. Jesus' performance of redemptive work on the Sabbath is later in this Gospel (5:16ff.; 7:21–24, 9:16) given the most suggestive theological treatment in the New Testament, apart from Hebrews 4."[7]

Turning water into wine is called Jesus first 'sign' (σημεῖον, *sēmeion*; 2:11). John prefers this word to other possible synonyms, because Jesus' miracles are never arbitrary or purposeless, but tell us something important about who Jesus is and the kingdom He is inaugurating. In John's Gospel, a sign miracle is always followed by either a response of belief or unbelief on the part of the audience—in this case, "his disciples believed in him" (2:11). The responses of belief and unbelief to Jesus' teachings and actions are significant throughout the Gospel, but especially so in response to the sign miracles.

Jesus as the agent of a new creation

In John 3, Jesus tells Nicodemus about the new birth—a creative miracle performed by the Holy Spirit in those who believe in Jesus. Just as Jesus was the agent of the original creation, He is the agent for the new creation, beginning with the spiritual regeneration of those who believe in Him.

Nicodemus came to Jesus at the very beginning of His public ministry. He had just cleansed the Temple; an action that Nicodemus, as a Pharisee, would not have been angered by, and might even have approved (at that time the Temple was controlled by the 'liberal' Sadducees). Jesus would spend much of the rest of His ministry railing against the hypocrisy and legalism of the Pharisees, but theologically He had much in common with them, including belief in angels and spirits and a future resurrection, which the Sadducees denied (Acts 23:8). Nicodemus's comments in this section indicate that they had not yet made up their minds about

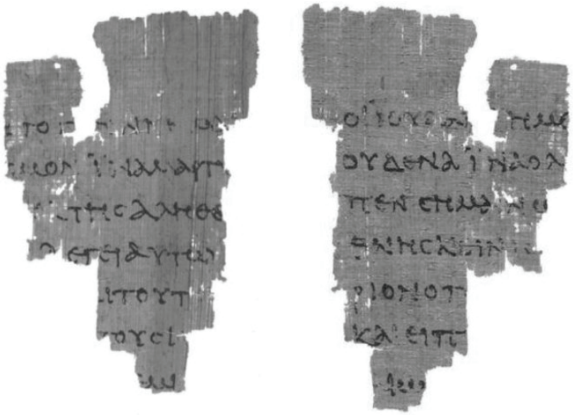

Figure 1. John manuscript P52, recto and verso. This second-century fragment disproved theories that John was written much later than the Apostle John's lifetime.

Jesus—they certainly had not started plotting against Him at this point.

It is common to suggest that Nicodemus came to Jesus at night because of cowardice, but this is not necessarily the case. Morris suggests that Nicodemus might simply have been exercising prudence, or simply practicality, by coming at night:

> "Nicodemus was a prominent man; since he was 'Israel's teacher' (v. 10), it would never do to commit himself to the unofficial Teacher from Galilee, not at any rate until and unless he was absolutely sure of his ground. ... The Pharisee may have chosen this time in order to be sure of an uninterrupted and leisurely interview. During the day Jesus would be busy and there would be crowds (crowds of common people!). Not so at night. Then there could be a long, private discussion."[8]

Nicodemus reports the consensus of at least some of the ruling class: Jesus is a teacher who has come from God because of the miracles Jesus has done (John 2:23). But Jesus challenges their idea that they have the ability to even evaluate Him; the expression, "Truly, truly, I say to you", "serves to draw a contrast between Nicodemus's opening statement and Jesus' response. ... Not human observation, reasoning, and 'believing' are required, but rather, a spiritual rebirth".[9]

This is not the answer Nicodemus would have expected to hear, which may explain his overly literalistic response. Jews believed that they all would enter the kingdom of God, except for those who apostatized or committed some great sin. Since their physical descent from Israel was thought to be sufficient (an idea Jesus specifically refuted), he did not believe that the utter transformation of an individual was a prerequisite to participation in God's kingdom.

Jesus clearly believed that someone who set himself up as a teacher of Israel ("the teacher of Israel" may refer in some way to Nicodemus's reputation as a great teacher in Israel) should be able to understand what He is saying. He insists that the new birth is real, although invisible as the wind, and that it is an absolute necessity for anyone who wants to enter the Kingdom of God.

Furthermore, Jesus claims first-hand knowledge of the truth about which He speaks. He echoes the first-person plural Nicodemus used in his introductory comments: "Truly, truly I say to you, we speak of what we know, and bear witness to what we have seen, but you do not receive our testimony" (3:11). In Jesus' analysis, Nicodemus's problem is not misunderstanding, but simple unbelief. And this unbelief about something that should have been simple for a 'teacher of Israel' to understand is a barrier to understanding the deeper truths that Jesus reveals to believers: "If I have told you earthly things and you do not believe, how can you believe if I tell you heavenly things?" (3:12). If Nicodemus doubts God's work that takes place on earth, how can he believe Jesus' testimony about things which occur in Heaven and thus are not observable? Carson puts forward this interpretation: "The 'heavenly things' are then the splendours of the consummated kingdom, and what it means to live under such glorious, ineffable rule."[10]

Jesus is able to speak about these heavenly realities because He has descended from Heaven (3:13). And just as Moses lifted up the bronze serpent to give life to those who had been bitten by the serpents in the wilderness (Numbers 21:4–9), Jesus would be lifted up so that all who look to Him in faith will receive the new spiritual birth. The "lifting up" (ὑψόω *hypsōo*) would eventually be back to heaven whence He came, but it's clear from John 12:32–34 that this *hypsōo* referred to being raised on the Cross.[11]

If Nicodemus had a response to all this, John does not record it. Rather, Nicodemus disappears from the narrative, to appear later in the Gospel (7:50; 19:39). John instead introduces his own commentary in 3:16–21. Most translations see these as the continued words of Jesus, but these verses have a clear post-Resurrection viewpoint, and John is careful not to impose that sort of anachronism in the events of Jesus' ministry.

Jesus gives life by His word

In John 4:46–54, Jesus heals an official's son who was at the point of death, simply by speaking. Jesus' ability to proclaim the boy to be healed without touching or even seeing the recipient of the healing was unique, and shows that Jesus, the Word, has the ability to give life to whomever He wants.

The official did not come with any notable faith. Rather, he seems to have come out of desperation, having heard that Jesus was a great worker of miracles. Jesus rebukes the Galileans in general as lacking faith, but seeking 'signs and wonders' (4:48). The man simply responds, "Sir, come down before my child dies" (4:49). Jesus replies, "Go; your son will live" (4:49). The father believed, indicating that he did not share the general Galilean interest only in signs and wonders. John records that the son actually did become well at the very moment Jesus said that he would live, resulting in the belief of the man's entire household. So we see that Jesus performed a greater miracle than the man requested; he wanted physical life for his son, while Jesus gave spiritual life for his whole household.

This miracle, as well as several others in John's Gospel, are designated as 'signs'. This shows that they were not spectacles in and of themselves, but they served to show his divine nature and authority, and thus challenged the recipients of the signs to respond.

Jesus' divine power and authority

After recounting a miracle that resulted in belief, John turns to a miracle that did not. Apparently, there was a superstition regarding the healing powers of the pool at Bethesda (figure 2), and an invalid man had been waiting to be healed there for 38 years. The man clearly believed that the pool was his only hope for healing—when Jesus asked if he wanted to be healed, the man could only think of the impossibility of getting to the pool in time. Not impeded by the man's unbelief, Jesus summarily commands him to rise with his bed, which the man did.

One would think that a miracle of this magnitude and personal importance would be met with instant gratitude and belief. However, when the Jews confronted the man for carrying his bed on the Sabbath, the man did not hesitate to tell them it was Jesus who told him to do it. And Jesus' own warning to the man indicates that he never had true saving belief (5:14).

When challenged about healing on the Sabbath, Jesus simply replied: "My Father is working until now, and I am working" (5:17). In other places, Jesus cited a perfectly acceptable, biblical reason for working on the Sabbath—to do good. Because it was lawful to break the Sabbath to rescue an animal from distress, arguing from lesser to greater, it was also lawful to break the Sabbath to relieve a human's distress caused by demon oppression. Because it was lawful to break the Sabbath to circumcise a baby boy, which was viewed in Judaism as a kind of completion of creation, it is lawful to break the Sabbath to complete a person by physically healing them. The apostles, or any

mere human who could do such things, would be able to use such an argument.

But the way Jesus elaborates makes it clear that He claims the prerogative of working on the Sabbath for the very same reason God does. In Judaism there was a debate about whether God obeys the Law He gave to Moses: specifically, does God work on the Sabbath? The Rabbinic conclusion was that God must work continually to uphold the universe, but that He does not break the Sabbath by doing so, because He does not carry anything beyond the permitted distance, He does not lift anything about His shoulders, and so on.

Jesus' argument is simple: He imitates His Father exactly, and His Father loves Him and has given Him authority. To honour one is to honour the other; to reject one is to reject the other. The truly startling claim to His audience would have been: "For as the Father has life in himself, so he has granted the Son to have life in himself." Jesus is basically claiming to have the relationship with the Father that John lays out in his prologue.

Just as the previous sign confirmed the man's faith, as well as that of his entire household, this sign confirmed that neither the man nor the Pharisees had true faith in Jesus. Other times, a sign provokes the wrong positive response, which is also held to be a form of unbelief, as when the people at the feeding of the 5,000 wanted to make Jesus king by force.

Figure 2. The ruins of the pool in Bethesda where Jesus healed the man who had been lame for 38 years

The man born blind

As the Gospel progresses, the Jewish leadership's opposition to Jesus intensifies, and unbelief becomes the typical reaction to Jesus, as much out of fear of the Jewish leaders as anything. One notable exception is the case of the man born blind. Healing a man born blind was thought, in Jewish tradition, to be a miracle that only the Messiah could perform. Jesus' use of mud made with dust and saliva may be intended to recall the creation of Adam out of dust.

Like the man at the pool of Bethesda, the man was ignorant of Jesus' identity—even more so, since he had been blind when he was in Jesus' presence before. But he had faith that Jesus was from God—he told the Pharisees that He was a prophet (9:17). This of course falls far short of Jesus' true identity, but it is impressive faith, especially considering that he must defy the Pharisees to make this proclamation. Indeed, by the end of their interrogation, he is calling himself a disciple of Jesus (9:27). When Jesus finally comes to him and reveals Himself, the man worships Him, indicating true belief (9:38).

Jesus restores life to Lazarus

In the other Gospels, Jesus raised Jairus' daughter and the son of the widow of Nain, but the only raising John records is that of Lazarus, and in many ways it is the most impressive. Jesus had a close relationship with Lazarus and his sisters Mary and Martha, but when they sent for Him, He waited until Lazarus was already dead before He even set out. By the time He arrived, decay would have set in. But Jesus raised Lazarus with a command (again, giving life by His word). Many believed in Him when they saw the miracle, but the Jewish leadership was only more determined to kill Jesus, and Lazarus too.

The Creator sacrificed

The allusions to creation are more veiled once Passion Week begins, because the focus turns to the meaning of the Cross. However, in the high priestly prayer (John 17:1–26), we get a glimpse of the interaction between the Father and the Son. Jesus has elsewhere insisted that He and the Father are absolutely unified, and we see the intimate fellowship within the Trinity in Jesus' prayer.

Jesus knows His hour has come, and understands the great significance of it. At this critical moment, His concern is to glorify the Father—yet He also asks, "And now, Father, glorify me in your presence with the glory I had with you before the world existed" (John 17:5). It would be insane and blasphemous to ask to share glory with God if Jesus were not actually God, because God shares his glory with no one else (Isaiah 48:11). There is also a claim to have pre-existed Creation; an idea that John introduced in his prologue. Jesus' request shows that the Incarnation involved 'emptying' Himself of His divine glory by adding human nature (Philippians 2:7). In His resurrection, His human body was resurrected and glorified, and He took on an even added dimension of glory as the Saviour of mankind.

In addition, Jesus prays, "Father, I desire that they also, whom you have given me, may be with me where I am, to see my glory that you have given me because you loved me before the foundation of the world" (17:24). This points back to the perfect fellowship and love shared by the members of the Godhead. There is no 'competition' among them for glory. Jesus delights in glorifying His Father, and the Father delights in glorifying the Son.

Verses later, John records the arrest of Jesus and, as throughout the rest of the Gospel, Jesus is portrayed as being in complete control. Jesus steps forward from the group of disciples and addresses the mob, and when he says *ego eimi*—a possible allusion to the divine name (cf. Exodus 3:14)—the reaction of the mob is to withdraw and fall to the ground. Carson believes this falls short of a theophany,[12] but most commentators see some significance to the language. Jesus must repeat Himself, and the second time he commands them to let his disciples go.

When Jesus was being mocked before the crucifixion, part of the degrading involved being mocked as the King of the Jews, crowned in thorns (19:2). While it is uncertain if this is a conscious reference to the Curse of Genesis 3:18 on John's part, it is fitting that the Last Adam should be crucified wearing a symbol of the Curse.

The Resurrected Creator

Only John gives the detail that there was a garden where Jesus was crucified (19:41). The first man, Adam, sinned in a Garden, and the last Adam atoned for sin in a garden and was entombed there. Mary Magdalene initially mistook the resurrected Lord for the gardener, a possible allusion to the vocation of the first man (20:15).

When Jesus first appeared to the disciples after the Resurrection, He breathed on them and said, "Receive the Holy Spirit" (20:22). This is analogous to when God breathed life into Adam (Genesis 2:7). Jesus was able to impart spiritual life to his disciples because He successfully atoned for their sin.

Conclusion—Jesus, Creator and Saviour

John's Gospel consistently portrays Jesus as the Creator, with creative power and authority that belongs only to God. And He portrays Jesus' mission in the Incarnation in terms of inaugurating a new creation through His atoning death and resurrection. Those who believe in Christ receive a new birth, making Christians part of the new creation (2 Corinthians 5:17), and preparing us for the future Kingdom of God in the restored world.

References

1. Morris, L., *The Gospel According to John*, p. 106, NICNT, Eerdmans, Grand Rapids, MI, 1995.
2. Carson, D.A., *The Gospel According to John*, p. 115, Pillar New Testament Commentary, Eerdmans, Grand Rapids, MI, 1991.
3. Wallace, D.B., *Greek Grammar Beyond the Basics*, Zondervan, Grand Rapids, MI, p. 269, 1996.
4. Carson, ref. 2, p. 117, and Kostenberger, ref. 9 (below), p. 28 make this argument.
5. Morris, ref. 1, p. 71.
6. Morris, ref. 1, p. 156.
7. Carson, ref. 2, p. 168.
8. Morris, ref. 1, p. 187.
9. Kostenberger, A.J., *John*, Baker Exegetical Commentary on the New Testament, Baker Academic, Grand Rapids, MI, p. 122, 2004.
10. Carson, ref. 2, p. 199.
11. Carson, ref. 2, p. 201.
12. Carson, ref. 2, p. 578.

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What life is

Alex Williams

The materialistic view of life as a natural phenomenon has been deeply contradicted by research into its molecular mechanics. In this article I briefly survey progress towards an explanatory theory of life based on molecular mechanics. The main proposition is that sustainable life is irreducibly cellular, and cell structure is irreducibly and continuously hierarchical and cyclic throughout its history in 4-dimensional space-time. One proof of this proposition lies in the cell wall. A primordial cell is irreducibly dependent upon its protective cell wall, which is irreducibly hierarchically and cyclically structured, and it is irreducibly dependent upon the cell contents for its topological continuity throughout its history in space-time. The cell contents, by the same argument, must have the same properties. Primordial life must be astonishingly complex: autotrophic, using Brownian machines to exploit thermal noise in quantum-engineering top-down-designed self-templated self-assembling substructures, while intelligently managing information exchange to ensure rational decision making in maintaining homeotic balance in the face of continuously conflicting demands from internal and external environments. Irreducible continuity of cell structure and function throughout its history in space-time defies naturalistic explanation. Only Genesis-style fiat creation can explain it.

Life is astonishing in its structure, function, and capabilities. Most professional scientists believe its origin lies in some chance combinations of aqueous organic chemistry, so they expect it to exist wherever there is liquid water in the universe.[1] Organic chemist Addy Pross, in his 2012 book *What is Life? How chemistry becomes biology,* gave an apparently sophisticated explanation by reverse engineering contemporary life back through imagined evolutionary time.[2] But this is self-delusion—it simply affirms what the author assumed (chemical evolution) and assumes what must be explained (cell structure, function, and capability). Nobel Prize winning biochemist Christian de Duve was a rare exception in acknowledging the pervasive obstacles in this worldview.[3]

In contrast, astrobiologist and philosopher of science Carol Cleland has observed that we need to know what life is before we can hope to explain its origin, and to do that we need "a general theory of living systems".[4] Harvard University's Nobel prize-winning origin-of-life researcher Jack Szostak has concluded that *cells* are the essential prerequisite:

> "… the question we're looking at is what do we need to do to make these chemicals get together and work like a cell?"[5]

Like others, Szostak began at the bottom and worked up towards increasing complexity and functionality, but without success (also like others). He then decided to study the transition to cellularity by building an artificial cell.[6]

However, Williams[7] has demonstrated that the primary structure required by a primordial cell is a strong cell wall to protect it from the destructive thermal energy of free water (called the 'molecular heat storm'). This has profound consequences, and in this article I review some of them to illustrate what life is, and thereby contribute to the development of a general theory of living systems.

The cell wall

A brief overview of different kinds of life demonstrates that all cells need protection from the destructive power of free water. Prokaryote cells (figure 1A) are protected by a strong fibrous or paracrystalline capsule. Eukaryote unicellular amoeba walls (figure 1B) have a majority composition (~75%) of strong molecules (proteins and phosphoglycans) interwoven through their cytoplasmic membrane to strengthen it while maintaining flexibility so the amoeba can crawl in complex ways to find and ingest food particles and avoid predators.[8] Unicellular paramecia (figure 1C) have a stiff, flexible, skin-like pellicle that protects the cytoplasmic membrane, which then overlays a polygonal network of fibres which anchor their body-covering cilia.[9] Multi-cellular plants (figure 1D), together with algae and fungi, have strong fibrous cell walls made from a variety of polysaccharides, including cellulose and chitin.[10] Multi-cellular animals (figure 1E) house their cells within a flexible, fibrous, extra-cellular matrix, which is thickened on the outside to produce a leathery skin. Unprotected animal cells in blood are kept safe through the blood serum being concentrated enough to neutralize the cell's osmotic pressure gradient. If blood is diluted with too much water, the cells burst.

Prokaryotes must be primordial in naturalistic scenarios because they are much simpler than eukaryotes. The capsule which protects the prokaryote could be compared to something like a leather football (figure 2A). The ball has an impervious rubber bladder that holds the contents

(compressed air) while an outer leather casing protects it from rupture when kicked. The prokaryote cell has an inner cytoplasmic membrane that guards the cell contents, and an outer capsule that protects it from rupture when exposed to the molecular heat storm (figure 2B). Prokaryotes have several variations in their wall structure and three are illustrated. Gram-positive bacteria have an inner phospholipid bilayer membrane and multiple strong layers of peptidoglycan fibres on the outside (figure 2C). Gram-negative bacteria have a phospholipid bilayer membrane outside as well as inside, with a strong peptidoglycan fibrous layer between them (figure 2D). Archaea have a phospholipid bilayer membrane on the inside and a paracrystalline pseudopeptoglycan strong layer on the outside (figure 2E).

No prokaryote capsule lacks a strengthening layer. This proves that lipid bilayer membranes alone are of no use to cells in the natural environment, yet they are the universal starting point in origin-of-life experiments. It's a fanciful delusion.

Cell wall construction

One of many stumbling blocks encountered by Szostak's team in constructing artificial cells is that the capsule holding the cell contents must expand as the cell grows, and it must divide when the cell divides. Synthetic capsules, like the plastic ones containing oral medications, are fixed in size—they do not grow or divide. So how does the prokaryote capsule do it? The same way that most of the other cell components do it—by 'self-templated self-assembly'.

To understand this remarkable mechanism (and its relevance to the origin of life) we need to look at a brief description of how, and why, humans use it:

> "Fabrication of [molecular] architectures from top-down technology involve[s] precise growth techniques like molecular beam epitaxy, chemical vapor deposition and also involve[s] patterning techniques such as photolithography, particle beam lithography, scanning probe lithography, and nanoimprint lithography. While the above mentioned processes are laborious, time-consuming, and costly, the 'bottom-up' technology based on [the] self-assembly approach is the simplest, cost effective technique. Self-assembly is one of the most important 'molecular engineering' strategies used in fabricating complex functional structures, from micro to the molecular levels, utilising the advantage of self-interaction of molecules. Molecular self-assembly is a strategy for nanofabrication that involves *designer molecules and supramolecular entities* so that molecules naturally aggregate into specific desired structures. This method reduces many difficult steps in nanofabrication … . Moreover, molecular self-assembly tends to produce structures that are relatively defect-free and self-healing, because *the target structures are selective with thermodynamically stable assembly* between the possible configurations [emphases added]."[11]

The gulf lying between a prokaryote capsule and an artificial capsule is that the prokaryote version is dynamic, undergoing continual turnover. As one end of a wall polymer self-assembles new material, the other end is enzymatically dismantled and recycled. When growth is required, an up-regulation of monomer supply at the growing end is sufficient to ensure the wall elongates in the right direction to accommodate the expanding cell contents. The pre-existing wall polymers act as templates on which the new material self-assembles. This has profound consequences for cell origin because it means that *new cell walls can grow only from pre-existing cell walls*. Self-templated self-assembly cannot arise out of a 'blank slate' origin, it can only *continue* from the wall of a pre-existing cell.[12] None of this is possible with artificial capsules.

As you can see from the quotation above, self-templated self-assembly is not a naturally occurring phenomenon. It requires "designer molecules and supramolecular entities" which can self-assemble at the right place because "the target structures are selective with thermodynamically stable assembly". That means the molecular machinery which accomplishes self-templated self-assembly is specially designed so that the statistical mechanics of physics and chemistry ensure that the single correct configuration is automatically chosen from the myriad wrong ones. Self-templated self-assembly is an ideal method of 'bottom up' construction, but it only works when the whole system is intelligently designed to function that way.

The cell contents

The constraints that the above facts place upon the cell contents also have profound consequences. The cell contents must be assembled in their entirety *before* the cell wall is sealed, otherwise the molecular heat storm would destroy it. Cell machinery is made of large polymers and they are prevented by the selective cytoplasmic membrane from getting into the cell *after* the wall is sealed off. Having everything ready at the beginning requires 'top-down' design. So it is not just the cell wall that requires top-down design but the entire cell contents also. Human engineers don't build bridges by randomly assembling bits of steel on river banks. If they did, either the resulting structure would fail under load, or it would be washed away in the next flood, or it would corrode into uselessness before anything functional emerged from its haphazard disarray. Instead, engineers first consider the challenges to be overcome,

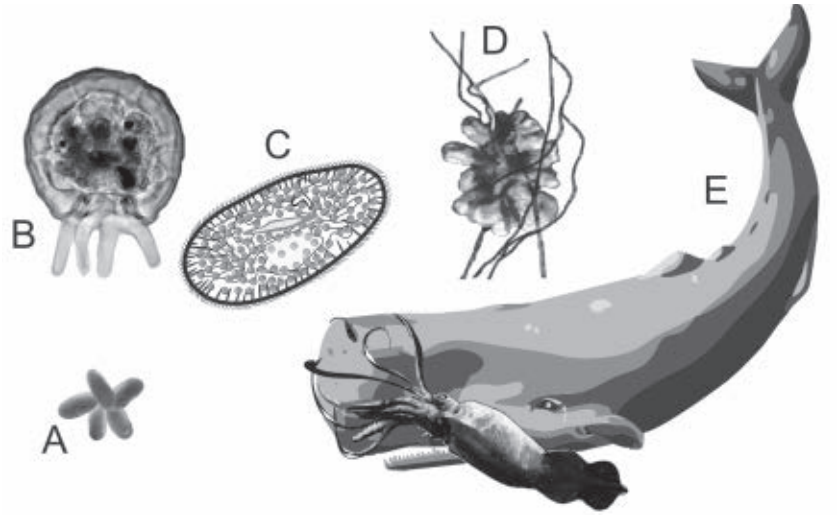

Figure 1. Life is irreducibly cellular. A—tiny archaea cells thrive even in extreme environments; B—a unicellular shelled amoeba builds a house from found objects and walks around on pseudopodia; C—a unicellular paramecium engulfs photosynthetic algae then keeps them to produce food; D—nitrogen-fixing bacteria infect roots of multi-cellular legume plants which then build a lobed nodule around them to live in and share food; E—a multicellular sperm whale hunts squid in the deep ocean.

then plan a set of structures that will meet those needs. Then structures are made and assembled according to the plan. This is top-down design and construction.[13]

With the cell contents safely inside the protective wall capsule, we can now begin to think about them in their entirety. Such an enterprise goes far beyond a journal article but some idea can be obtained from EcoCyc, the *E. coli* modelling project. The 'Metabolic Cell Overview' option provides a zoomable diagram of the bacterial cell with metabolic pathway annotations.[14] I will consider just some of its general principles.

One of the first points that Nobel Prize winning physicist Erwin Schrödinger identified in his 1944 book *What is Life?* was that the laws of physics and inorganic chemistry are based on the statistical mechanics [random interactions] of large numbers of atoms and molecules, and they have no power to explain the extraordinary behaviour of living organisms. Of special interest to Schrödinger (given the technological limitations of his time) was the curious behaviour of chromosomes during reproduction. Only organic chemists had made any progress by uncovering the remarkable structures of biochemical molecules and some of the metabolic cycles that are unique to life.[15] Schrodinger thus identified that it was the unique *structures* of biomolecules that provided clues to the distinctive *functions* of living organisms.

In 1968 Michael Polanyi elaborated on this principle by noting that life's machines displayed *irreducible hierarchical* structure and this was the key to understanding their functions.[16] However, Schrödinger ingeniously calculated that cellular machinery must function at a scale where the thermal energy of its atoms and molecules (the 'molecular heat storm') constantly interferes. This

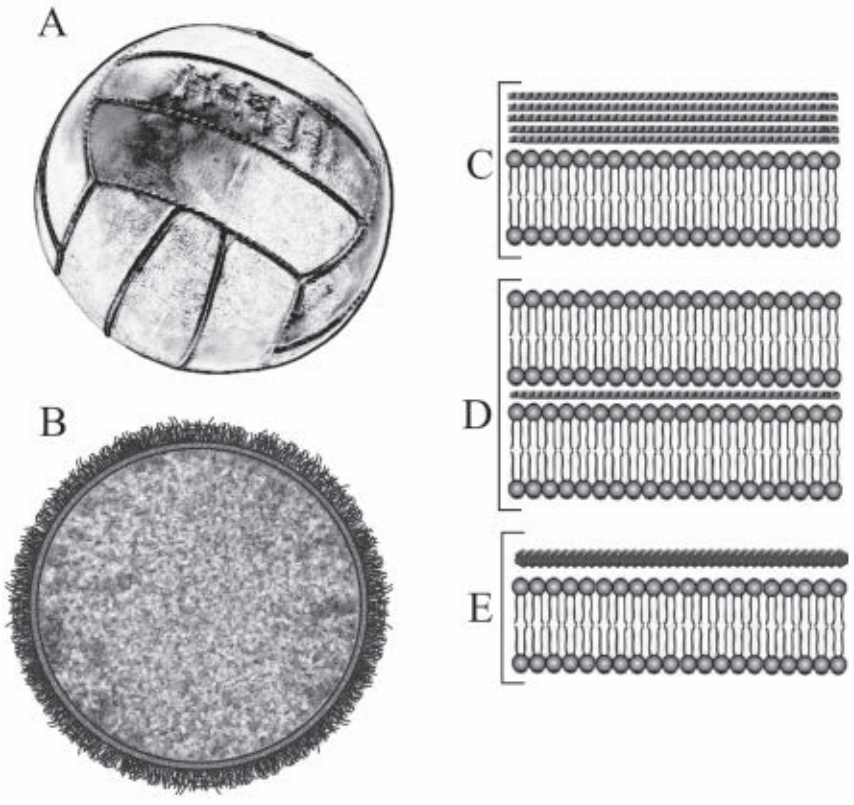

Figure 2. Prokaryote cell wall structure. A—Leather football illustrates the principles. B—Schematic cross-section of a rod-shaped bacterium. Schematic wall sections of: C—Gram-positive bacteria, D—Gram-negative bacteria, E—Archaea.

changes the game entirely from what Polanyi envisaged. To solve this problem, Schrödinger proposed that strong molecular bonds must hold large molecules together, and that these large molecules must have the ability to make quantum-like jumps between different stable states. He then formulated a definition of life as "that which avoids rapid decay [through thermal degradation of its structures] into the inert state of equilibrium [where function ceases]".[17]

With modern atomic force microscopes (AFMs) we can now see Schrödinger's predictions regarding thermal energy fulfilled throughout the cell.[18] Furthermore, the most important functional 'strong molecules'—proteins and DNA—do indeed undergo quantum-like jumps between stable states. Proteins can undergo allosteric conformational changes, and DNA can change its four-base coding sequences. But even more spectacularly, crucial events in the cell are now known to involve *real* quantum-state transitions.[19] Implications for the origin of life are staggering.

Human excursions into the quantum world usually require enormous effort and cost. Particle accelerators have to generate extremely high energies and temperatures to access the subatomic world. Quantum superconductivity requires extremely low temperatures and ultra-pure materials. But protein machines in a cell can tap into the molecular heat storm and use its incessant chaos to access quantum transitions without changing the temperature a single degree! Humans can engineer quantum phenomena at room temperature too, but it requires the highest standards of ingenuity, design, construction, and operation of equipment.[20]

Life's dependence upon quantum engineering is all-pervasive. To avoid thermal degradation, all cells need continuing supplies of energy and nutrients, and they must extract these from the environment. *Autotrophs*—cells that can manufacture food from sunlight, inorganic chemicals, or electrons—are the only kind of cells that could have been primordial. *Heterotrophs*—cells that rely on organic food from outside (e.g. primordial soup)—would soon have exhausted their local supply and died out. Earth's biosphere is maintained by a vast network of autotrophs, providing food for heterotrophs, then recyclers turn it all back into raw materials to be used over and over again. Any sustainable biosphere must do likewise.

One well-studied autotrophic prokaryote, *Rhodospirillum rubrum,* a purple proteobacterium commonly found in mud, gives some idea of what is required. It can grow aerobically or anaerobically, in dark or light, extracting energy via cellular respiration, fermentation, photosynthesis, or photoautotrophic growth. A supercomputer simulation of its chromatophore harvesting light reveals a marvel of quantum-inclusive engineering.[21] During photosynthesis light energy is converted into chemical food energy via a 'special pair' of chlorophyll molecules embedded slightly off-centre to one another in a surrounding protein matrix. Their mutually interacting but 'out of tune' vibrations allow them to amplify quantum interference effects that 'tune out' wasteful energy transfer routes and 'tune in' only the most efficient ones. The resulting energy efficiency is almost 100%, far exceeding the theoretical limit set by the laws of thermodynamics.[22]

Proteins are fundamental to all life, and their structure and function both depend upon quantum engineering. Proteins are made up of long chains of amino acids strung together via distinctive 'peptide bonds'. These bonds require special enzymes (also made of proteins) to make them in the necessary presence of (otherwise destructive) water,[23] and also to break them (for repair and recycling). They use "precision engineered" equipment to access unstable quantum-transition states and achieve what would otherwise be impossible.[24] Furthermore, all cells depend heavily upon electron transfers, and it appears that proteins are a major component of cellular electronics. They can access quantum-critical states and behave as semi-conductors, which are the centrepiece of our electronic devices.[25]

Systems biology

Many biologists now realize that life only makes sense as a whole. 'Systems biology' takes reductionist research results and puts everything together to build a big picture of how organisms work as a whole. The crucial difference between a living *process* (e.g. protein production from DNA) and a living *system* is that the living system has a *cyclic* structure. Proteins require DNA to define their amino acid sequence, but DNA also requires protein to yield up its coded information that defines the amino acid sequence. The protein production stage is entirely useless without the information management stage. Both are required *concurrently* for either stage to be functional.

But over the top of this particular cycle there must also be a genomic control process that regulates gene activity by determining which genes are switched on at any one time and which are switched off. The gene regulatory process must also be cyclic because everything a cell does is repeated continuously over various timescales, culminating in the reproductive cycle. However, feeding into every level of this complex cycle-of-cycles there needs to be energy, nutrient, and manufacturing supply chains; removal of waste products; and component building, maintenance, repair, and recycling routines. All of these subsystems must also be cyclic because the output of any one routine is always the input to another one somewhere else, and all the pieces need to be broken down and recycled back into the system so

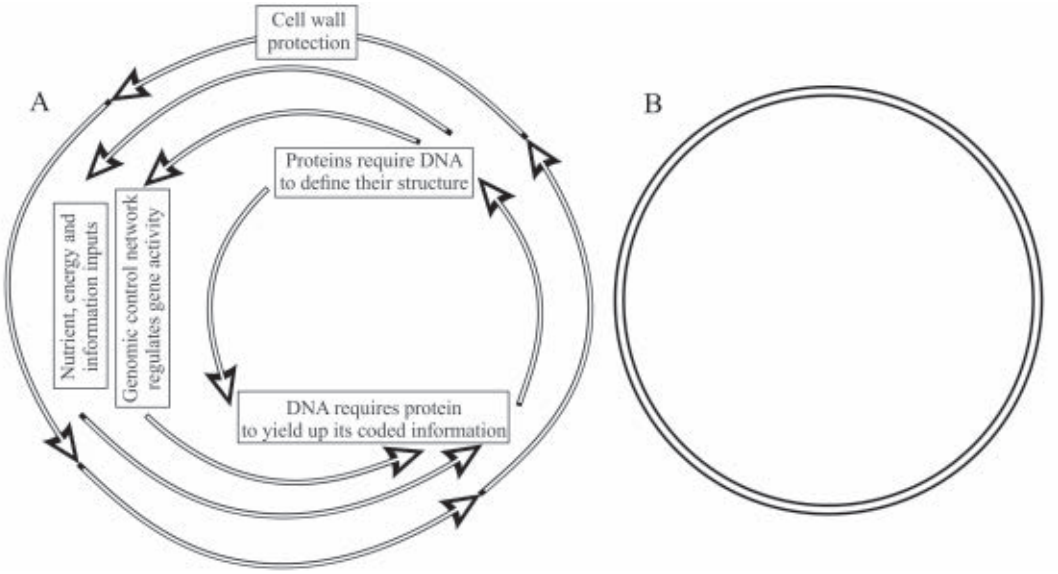

Figure 3. Cell cycles (A) are topologically equivalent to circles (B).

that waste does not build up to toxic levels. Nothing works alone. Everything must work together. And it all needs to be up and running *in full functionality* before it is sealed inside the primordial cell wall. It takes about 1 nanosecond for free water molecules to cross the space inside a prokaryote cell, which means the contents must be assembled on at least a picosecond timescale.

The complexity of life's cyclic processes (figure 3A) is so great that we easily lose sight of their essential simplicity. A cycle is topologically equivalent to a circle (figure 3B). In a circle there is no beginning and no end. Each point on the circle is continuous with the ones either side of it. Each point is as necessary as every other point.

Life is not just a collection of special molecules, it is a hierarchically integrated, robust, and self-regulating system. Some first steps in capturing its complexity can be found in *The Handbook of Systems Biology: Concepts and Insights*.[26] The most important point the book makes is that life functions *only* as a system.[27] Michael Savageau, Distinguished Professor of molecular biology at UC Davis, has recast Theodore Dobzhansky's famous statement about evolution into this new light: "Nothing in biology makes sense except in the light of systems."[28]

A modern-day smart phone provides a useful analogy for the holistic nature of systems biology. When we press the ON button, amazing things happen because thousands of lines of coded information inside the phone spring into action. The nearest wireless telephone tower is activated and messages from all around the world flow into the palm of your hand. The smart-phone provides a galaxy of electronic technology packed small enough to hold in one hand, but big enough to enable watching of TV and movies. Now compare that with a cultured stem cell from a Tasmanian blue gum tree. Apply a drop of *cytokinin* and a young gum tree begins to grow, but it has no roots. Transfer the tiny tree to a new medium that has *auxin* in it and the roots begin to grow. After further appropriate care it can be planted out into the wild and grow up to become one of the largest hardwood trees in the world. Now take a fertilized egg from a zebrafish and apply *BMP4* to one end and *Nodal* to the other end. Just like pressing the ON button on the smart phone, the embryo turns into a fish (it does take a bit longer). One button to activate a smart phone and two 'buttons' to activate a gum tree and a fish. Everything needed to produce all the action is packaged into the hand-held phone, and likewise into the tiny *single cells* that produced the living organisms. Life comes as a complete package in just one, whole, tiny cell.[29]

Cells are intelligent

A crucial property of living systems identified by the founder of General Systems Theory,[30] Austrian biologist Ludwig von Bertalanffy, is that they maintain themselves very far from physical equilibrium in *open* systems that cannot survive *apart* from their environments. This property has profound consequences. Cells must always remain *closed* to the environment to protect their contents from hazards, but simultaneously must remain *open* to their environment for material and information exchange. To maintain a homeotic balance in the face of these continually changing and conflicting challenges, cells must make rational decisions which minimise the risks and maximise the benefits of every transaction.

In 1983 microbiologist James Shapiro published an article entitled "Variation as a genetic engineering process".[31] Over the next three decades he developed this idea into the concept of 'natural genetic engineering (NGE)'—the notion that cells (not genomes) are in control of life, and that bacteria in particular are intelligent agents in charge of their own metabolism, social history, and hereditary potential.[32] It was most fully explained in his 2011 book *Evolution: A view from the 21st century*.[33] It drew heavy criticism from neo-Darwinists, but Shapiro is confident their theory has been soundly refuted.[34] In a clarification of what "natural genetic engineering does and does not mean" he said this:

> "NGE describes a toolbox of cell processes capable of generating a virtually endless set of DNA sequence structures in a way that can be compared to erector sets, LEGOs, carpentry, architecture or computer programming. NGE operations are not random. Each biochemical process has a set of predictable outcomes and may produce characteristic DNA sequence structures. The cases with precisely determined outcomes are rare and utilized for recurring operations such as *generating proper DNA copies for distribution to daughter cells* [emphasis in original]."[35]

In other words bacteria can engineer their genomes in different ways for different purposes. They can copy them with 100% accuracy when required, and they can dice and slice and mix them with foreign DNA of any and every kind. Shapiro concludes that "bacteria are the most successful cell biologists on the planet".[36] He has now been joined by a range of other biologists in different fields making similar claims that cells are intelligent agents.[37–39]

The 'attention schema' theory of animal consciousness illustrates how intelligence works. It consists of a three-tiered hierarchy.[40] At the base is a network of sensory inputs. In the middle is an information processing system. And at the top is a holistic response mechanism. Holistic response does not occur after every sensation but is triggered only under certain circumstances. Those circumstances have to be mediated (but not necessarily determined) by the information processing system. In humans, conscious awareness is a whole-of-brain experience that focusses attention upon just some sensory inputs but not others.[41] The subconscious information processing system determines which stimuli are brought to conscious awareness, then the consciousness determines what the holistic response will be.

Bacteria do not have human-like self-awareness, but they certainly do have bacterial self-awareness. Just one individual bacterium can do everything described here, which means it must be doing so for its own sake. Its behaviour is not merely some emergent property of group dynamics. Bacteria also have a three-tiered hierarchy of sensory input, information processing, and holistic response.[42] They have thousands of receptor molecules in their outer walls and can sense dozens of different kinds of stimuli, including chemical, mechanical, biological, heat, light, and vibration sources. Memory and a sense of the flow of time are essential components. Cells maintain short-term memory regarding increasing and decreasing trends in both internal and external conditions,[43] and long-term memory in regard to diurnal cycles and cell history, including periods of asexual and sexual reproduction and dormancy. Cells can count numbers of molecules and measure concentrations of chemicals, and they can do calculations, including 'greater than,' 'less than', and 'equal to' comparisons. They can also do Boolean algebra in 'if … then' logical circuits using operators, including AND, OR, and NOT. Then they integrate all this data in ways that produce rational decision making (e.g. swimming towards food and away from toxins, deciding when to cooperate and when to compete with neighbours).

Cell decision making is much more than built-in algorithmic reaction. When faced with multiple conflicting signals and internal demands, multiple possible threats, multiple courses of possible action, and multiple possible outcomes, we can observe individual prokaryotes making decisions that humans would agree are rational in the circumstances. Shapiro admits that we do not yet know *how* they do it but: "[It] almost certainly … [is] more than a strictly mechanical process. … [it] will certainly involve cybernetics. … [and the mechanism may be] more than strictly material … ."[35]

Intelligences communicate. For example, to remain healthy every cell in a multi-cellular organism must cooperate with its neighbours. This is achieved via a multiplicity of signalling and receptor pathways—the cells must share and respond to neighbourhood information. If cells break the cooperation rule it results in diseases like cancer and autoimmune disorders. Cooperation is just as necessary in prokaryotes when one cell divides and produces a dense colony of offspring,[44] and when one species cooperates with other species to form the complex biofilms that are active agents in ecosystems[45] and pathogenesis,[46] and in the consortiums which achieve biochemical reactions not possible in component species.[47] Bacteria can communicate with other members of the same species, with members of different species, and with higher organisms, including plants, animals and fungi. A rapidly increasing list of completely different kinds of organisms is now known to communicate with one another. Vastly different organisms routinely live intimately together or inside one another, sharing common resources, including information via cell-signalling. Most plants actively engage with microbes, including fungi, in their root zones to complement (or even replace in some orchids and cycads) the normal functions

of their root systems. The human body is host to a vast and growing catalogue of species. Cloning experiments show that cells of quite different species can be grown peaceably together in one body. Healthy human organs can grow in the bodies of pigs, sheep, rabbits, and mice.[48] Human genes can operate in the bodies of plants, yeast, fruit flies, and bacteria. The language of life—not just reading the genetic code, but perceiving and acting in accordance with living *systems*—appears to be universal.

Prokaryotes thrive in every moist environment on earth, demonstrating beyond doubt that they are supremely good at being aware of, responding to, and communicating with their surroundings in a rational manner.

Genetic entropy

Cellular machines use the laws of physics, but they must also obey them. The fact that they live among and use thermal noise has earned them the name 'Brownian machines'.[49] Amazingly, their most energy-efficient point to operate is where their frequency of vibration matches the noise.[50] The 'dance of life' is choreographed on the edge of chaos,[19] and this may allow them greater flexibility than if they operated in a calmer environment.[51] Not surprisingly, damage is frequent and much of the cell's machinery is devoted to maintenance and repair (especially DNA) and efficient breakdown and recycling of worn-out parts. Lifetimes of RNA and proteins in bacteria are measured in just minutes.[52] Mutation is more a result of physics than biology.[53] A detailed study of the 1918 influenza virus genome showed that the mutations which caused its extinction (twice) were "overwhelmingly the product of thermodynamics".[54] The main biological contribution is that natural selection can remove the rare lethally deleterious mutations, but not the common sublethally deleterious ones. Since the latter are the vast majority they accumulate and

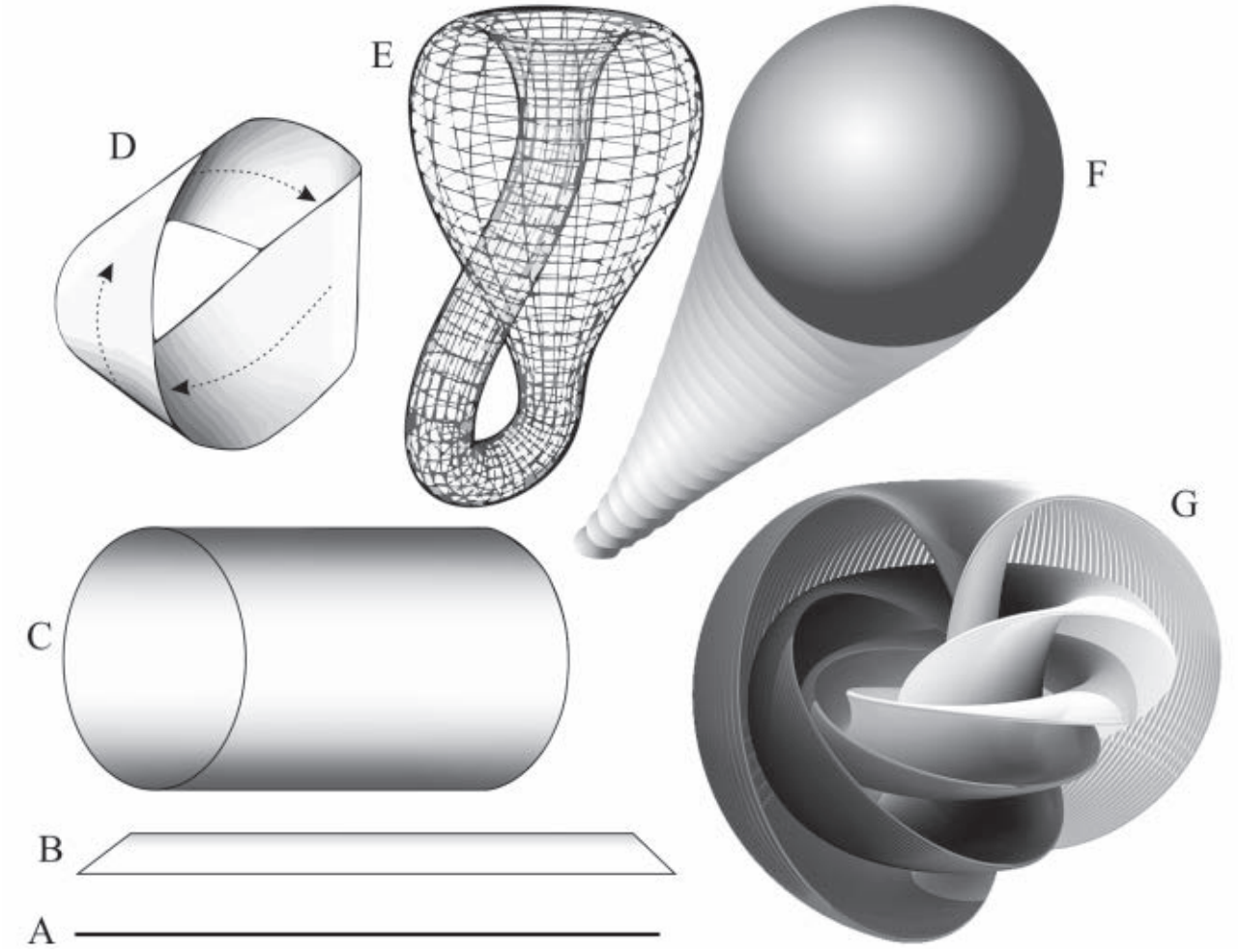

Figure 4. Topologically continuous objects that progressively illustrate the concept of the cell as a 4-dimensionsal hypersphere. A—line; B—plane; C—cylinder; D—Mobius strip; E—Klein bottle; F—backwards projection of a sphere; G—partial view of a Hopf Fibration, a mathematically accurate mapping of a 4-dimensional hypersphere into 3 dimensions.[60]

multiply across generations, degrading fitness to the point of extinction.[55,56] Genetic entropy confounds Darwinism, sets a short timescale for life on earth,[57] and demands the highest possible primordial engineering standards.[58]

Topology of the cell

Topology is a branch of mathematics that deals with continuity.[59] Metabolic cycles in a cell are continuous entities and topologically equivalent to 2-dimensional circles, but since they always cycle over time they are more like three-dimensional helices. Similarly, the prokaryotic capsule is topologically equivalent to a 3-dimensional sphere, like the football in figure 2, but it is also dynamic in *spacetime* so it is more like a 4-dimensional hypersphere. Because the capsule must *always* protect the cell contents from the molecular heat storm, but is itself *always* dependent upon the cell contents for its maintenance, growth and division, it must have *topological continuity* throughout its history in spacetime. Since the cell contents are *always* dependent upon the capsule for protection, they too must have topological continuity throughout their history in spacetime. Figure 4 contains some topologically continuous objects that illustrate these concepts.

The simplest continuous object is a 1-dimensional line (figure 4A). Increasing in dimensions and complexity are a plane (4B) and a cylinder (4C). Figure 4D, a Mobius strip, symbolizes how the cell wall on the outside is necessarily continuous with the inside metabolism. Figure 4E, a Klein bottle, makes the same point with a container. Figure 4F is a simple backwards projection of a sphere to symbolize that the cell is continuous back through time. Figure 4G, a partial view of a Hopf Fibration,[60] is a mathematically accurate mapping of a 4-dimensional hypersphere into 3 dimensions, and it thus gives a more accurate representation of the cell's continuity throughout its history in spacetime.

Conclusions

Life is irreducibly cellular, and cells function only as whole systems, continuously protected from the environment inside a strong cell wall. The necessity for the cell wall to be sealed from the beginning against the external violence of the molecular heat storm has spectacular consequences. The cell contents must be assembled in complete functionality inside the cell wall before the cell wall is sealed, and the cell, as a unit, must remain continuously functional throughout time (apart from special cases of dormancy) for life to avoid thermal decay. Yet cells also need to remain continuously open to their environment for material and information exchange. Managing a homeotic balance in the face of these challenges requires intelligent sensation of both internal and external conditions together with rational decision making. Primordial cells must also be autotrophic. Achieving these things concurrently requires the highest standards of molecular and quantum-mechanical engineering skill at ambient temperatures and picosecond timescales. No naturalistic scenario has ever come even near to meeting such criteria. Yet, despite these high standards of technological excellence, genomes are decaying on timescales of just thousands of years.

This very brief characterization of life can be conveniently summarized in the topological concept of continuity in all essential features throughout its history in 4-dimensional space-time. Continuity is an absolute criterion—it must be present from the beginning or the cell is destroyed by the molecular heat storm. Continuity cannot be added at some later stage to a 'porous bag' of 'sloppy molecules' in a step-wise Darwinian process of 'bottom-up' assembly over many generations. The materialistic view of life as a natural phenomenon is indefensible. Only Genesis-style fiat creation can explain it.

References

1. Irwin, L.N., Méndez, A., Fairén, A.G. and Schulze-Makuch, D., Assessing the Possibility of Biological Complexity on Other Worlds, with an Estimate of the Occurrence of Complex Life in the Milky Way Galaxy, *Challenges* **5**:159–174, 2014; doi:10.3390/challe5010159.
2. Pross, A., *What is Life? How chemistry becomes biology*, Oxford University Press, 2012.
3. Christian de Duve, *Singularities: Landmarks on the Pathways of Life*, Cambridge University Press, 2005.
4. Mullen, L., Defining Life, *Astrobiology Magazine*, 19 June 2002, www.astrobio.net/news-exclusive/defining-life/.
5. Making Life from Scratch: Biochemist Jack Szostak's Search for the First Cell (2012), origins.harvard.edu/pages/research-spotlight-jack-szostak, 17 June 2014.
6. Blain, J.C. and Szostak, J.W., Progress Toward Synthetic Cells, *Annual Review Biochemistry* **83**:11.1–11.26, 2014.
7. Williams, A.R., What Life Isn't, *J. Creation* **29**(1):108–115, 2015.
8. Korn, E.D. and Wright P.L., Macromolecular Composition of an Amoeba Plasma Membrane, *J. Biological Chemistry* **248**(2):439–447, 1973.
9. Sedar, A.W. and Porter, K.R., The fine structure of cortical components of *Paramecium multimicronuleatum*, *J. Biophysical and Biochemical Cytology* **1**(6):583–604, 1955.
10. Domozych, D.S. *et al*., The cell walls of green algae: a journey through evolution and diversity, *Frontiers in Plant Science* **3**:Article 82, 2012.
11. Pradeesh, K. *et al*., Naturally Self-Assembled Nanosystems and Their Templated Structures for Photonic Applications, *J. Nanoparticles* vol. 2013, Article ID 531871, 2013, dx.doi.org/10.1155/2013/531871 .
12. Oliferenko, S. *et al*., Positioning cytokinesis, *Genes & Development* **23**: 660–674, 2009.
13. Burgess, S., *Hallmarks of Design: Evidence of purposeful design and beauty in nature*, 2nd edn, Day One Publications, Leominster, pp. 30–31, 2004.
14. ecocyc.org/overviewsWeb/celOv.shtml#, 20 Aug 2015.
15. Schrödinger, E., *What is Life?: The Physical Aspect of the Living Cell*, Cambridge University Press, ch.2,1944.
16. Williams, A.R., Life's Irreducible Structure—Part I: Autopoiesis, *J. Creation* **21**(2):109–115, 2007.
17. Schrödinger, E., *What is Life?: The Physical Aspect of the Living Cell*, Cambridge University Press, 1944, ch. 6.
18. Hoffmann, P.M., *Life's Ratchet: How Molecular Machines Extract Order from Chaos*, Basic Books, New York, 2012, Kindle Edition.

19. Al-Khalili, J. and McFadden, J., *Life on the Edge: The coming age of quantum biology*, Bantam Press, London, 2014.
20. Yirka, B., Demonstration of room temperature spin transport in germanium, 25 May 2015, phys.org/news/2015-05-room-temperature-germanium.html, accessed 26 May 2015.
21. Chandler, D., Strümpfer, J., Sener, M., Scheuring, S. and Schulten, K., Light Harvesting by Lamellar Chromatophores in *Rhodospirillum photometricum*, *Biophysical J.* **106**(11):2503–2510, 2014.
22. Al-Khalili and McFadden, ref. 19, p. 127.
23. Sarfati, J., Origin of life: the polymerization problem, *J. Creation* **12**(3):281–284, 1998, creation.com/images/pdfs/tj/j12_3/j12_3_281-284.pdf.
24. Al-Khalili and McFadden, ref. 19, ch. 3.
25. Hewitt, J., Quantum Criticality in life's proteins, phys.org/news/2015-04-quantum-criticality-life-proteins.html, 13 April 2015.
26. Walhout, A.J.M. *et al*. (Eds.), *Handbook of Systems Biology: Concepts and Insights*, Academic Press, London, 2013.
27. Carvunis, A-R. *et al*., Interactome Networks; in: Walhout, A.J.M. *et al.* (Eds.), *Handbook of Systems Biology: Concepts and Insights*, Academic Press, London, ch. 3, 2013,.
28. Savageau, M., Phenotypes and design principles in system design space, hh.15, p. 288; in: Walhout, A.J.M. *et al.* (Eds.), *Handbook of Systems Biology: Concepts and Insights*, Academic Press, London, 2013.
29. Williams, A.R., Heredity is foundationally cellular, not genetic, and the history of life is discrete, not continuous, *J. Creation* **28**(3):73–79, 2014.
30. von Bertalanffy, L., *General System Theory: Foundations, Development, Applications*, George Braziller, New York, 1968, revised edition 1976.
31. Shapiro, J.A., Variation as a genetic engineering process. In *Evolution from Molecules to Men* (D.S. Bendall, Ed.), Cambridge University Press, pp. 253–270, 1983.
32. Shapiro, J.A., Bacteria are small but not stupid: cognition, natural genetic engineering and socio-bacteriology, *Studies in the History and Philosophy of Biology & Biomedical Sciences* **38**:807–819, 2007.
33. Shapiro, J.A., *Evolution: A view from the 21st century*, FT Press Science, Upper Saddle River, NJ, 2011.
34. en.wikipedia.org/wiki/Natural_genetic_engineering, 21 August 2015.
35. Shapiro, J.A., *What Natural Genetic Engineering Does and Does Not Mean*. Posted: 28/02/2013, www.huffingtonpost.com/james-a-shapiro/what-natural-genetic-engi_b_2783419.html.
36. Shapiro, J.A., *Inter-Kingdom Horizontal DNA Transfer in All Directions: Infectious Bacteria Evolve by Acquiring Protein Domains From Eukaryotic Hosts*, updated 06/01/2013, www.huffingtonpost.com/james-a-shapiro/interkingdom-horizontal-d_b_2081420.html?ir=Australia.
37. Trewavas, A., *Plant Behaviour and Intelligence*, Oxford University Press, 2014.
38. Mancuso, S. and Viola, A., *Brilliant Green: The surprising history and science of plant intelligence*, Island Press, Washington D.C., 2015.
39. Karban, R., *Plant Sensing and Communication,* University of Chicago Press, 2015.
40. Graziano, M., How consciousness works, *Aeon Magazine*, 21 August 2013, aeon.co/magazine/philosophy/howconsciousnessworks/.
41. Moran, M., Network theory sheds new light on origins of consciousness, medicalxpress.com/news/2015-03-network-theory-consciousness.html, 11 March 2015.
42. Bray, D., *Wetware: A computer in every living cell*, Yale University Press, New Haven, 2009.
43. Lambert, G, and Kussell, E., Memory and Fitness Optimization of Bacteria under Fluctuating Environments, *PLoS Genet*ics **10**(9): e1004556, doi:10.1371/journal.pgen.1004556, 2014.
44. Shapiro, J.A., Multicellularity is the rule, not the exception: Lessons from *E. coli* colonies; in: Shapiro, J.A. and Dworkin, M. (Eds.), *Bacteria as Multicellular Organisms*, Oxford University Press, 1997, pp. 14–49.
45. Gautam, C.K. *et al.*, Review Article: An insight into biofilm ecology and its applied aspects, *International J. Pharmacy and Pharmaceutical Sciences* **5**(4):69–73, 2013.
46. Kostakioti, M. *et al*., Bacterial Biofilms: Development, Dispersal, and Therapeutic Strategies in the Dawn of the Postantibiotic Era, *Cold Spring Harbour Perspectives in Medicine* **3**:a010306, 2013.
47. Shapiro, J.A., *Evolution: A View from the 21st Century*, Pearson Education, Kindle Edition, 2011, p. 101.
48. A good review of chimeric research and its ethical implications is at: Human/Non-Human Chimeras, *Stanford Encyclopedia of Philosophy*, plato.stanford.edu/entries/chimeras/ revised 2014.
49. Guohui Li and Qiang Cui, Analysis of functional motions in Brownian molecular machines with an efficient block normal mode approach: Myosin-II and Ca21-ATPase, *Biophysical J.* **86**:743–763, 2004.
50. Schneider, T.D., 70% efficiency of bi-state molecular machines explained by information theory, high dimensional geometry and evolutionary convergence, *Nucleic Acids Research* **38**(18):5995–6006, 2010.
51. Ball, P., The borders of order: Do all living things exist at the edge of chaos? *New Scientist* **2966**:44–47, 2014.
52. Milo, R. & Phillips, R., *Cell Biology: by the numbers*, pp. 294–298 (June 2015 draft), Garland Science, book.bionumbers.org/how-fast-do-rnas-and-proteins-degrade/, accessed 29 May 2015.
53. Williams, A.R., Mutation: Evolution's Engine becomes Evolution's End, *J. Creation* **22**(2):60–66, 2008.
54. Carter, R.W., More evidence for the reality of genetic entropy, *J. Creation* **28**(1): 16–17, 2014.
55. Sanford, J.C., *Genetic Entropy & the Mystery of the Genome*, FMS Publications, New York, 3rd edn, 2008.
56. Marks, R.J., Behe, M.J., Dembski, W.A., Gordon, B.L. and Sanford, J.C. (Eds.), *Biological Information: New Perspectives*, World Scientific Publishing, Singapore, 2013.
57. Williams, A.R., Healthy genomes require recent creation, *J. Creation* **29**(2): 70–77, 2015.
58. Williams, A.R., Human genome decay and the origin of life, *J. Creation* **28**(1): 91–97, 2014.
59. en.wikibooks.org/wiki/Topology/Continuity_and_Homeomorphisms, 21 August 2015.
60. wikipedia.org/wiki/Hopf_fibration, 25 August 2015.

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Cnidarians turn evolutionary theory into jelly

Jean O'Micks

Phylum Cnidaria, which includes animals such as sea anemones, corals, hydras, and jellyfish, has interesting characteristics that impinge on the origins debate. According to evolution, cnidarians occupy a fairly basal position in the branch of the evolutionary tree that leads to animals with bilateral symmetry (the Bilateria). Several cnidarian species have been used to study the origins of several tissue types, including neural tissue, because of surprising similarities with vertebrates. It is paradoxical that such cellular structures, tissues, and organs would be conserved across the animal kingdom. In other words, many basic cell and tissue types, and the genes that control them, were already present in very early animal organisms, and barely changed or evolved over the supposed 700 Ma since the Precambrian. Cnidarians also have genes in common with vertebrates that are missing from insects and worms. Sensationally, these soft-bodied creatures have also been found as fossils, where modern species barely differ from fossilized ones. A characteristic cnidarian cell type is the nematocyst; a highly specialized cell that contains a spear-like structure used to capture prey, and which represents an irreducibly complex biological system. Cnidarians thwart evolution in a number of ways.

The position of Cnidaria within the animal kingdom

The main animal phyla are depicted in figure 1. Cnidarians are considered to be the first organisms after sponges (Porifera) to have real tissues. In some groups (including modern corals and the extinct tabulate and rugose corals) development even of the radially symmetric adult form occurs along bilateral lines. Yet, they are considered to still have radial symmetry, as opposed to animals with true bilateral body plans (Bilateria). The Bilateria are divided into two main groups, the protostomes and deuterostomes, depending on whether the blastopore, the first opening in the embryo, forms the mouth (protostomes) or the anus (deuterostomes). There are five classes within Phylum Cnidaria: Anthozoa (including corals and sea anemones), Cubozoa (box jellies), Scyphozoa (true jellyfish), Staurozoa (stalked jellyfish), and Hydrozoa (including hydra and Portuguese-man-o-war).[1,2] Cnidarians have been divided into two main subphyla, the Anthozoa and Medusozoa, which are thought to have separated early on in cnidarian evolution, 580 MYA at the latest. Anthozoa is held to be the more basal group, with Medusozoa, based on mitochondrial DNA structure and rRNA sequences. Interestingly enough, the split between these two groups is supposed to be as old as the split between protostomes and deuterostomes.[3,4]

Early organ and tissue complexity

One of the fascinating aspects of studying cnidarians, represented by the model organism, *Nematostella vectensis* (the starlet sea anemone), is that the gene repertoire of its body plan is close to that of vertebrates. Its genes code for relatively complex neural structures which are important for the development of further traits, such as mesoderm and bilaterality in the early stages of their lives.[5] This is supported by the fact that *N. vectensis* has 56 homeobox genes, which are responsible for delineating the limbs and body regions of higher organisms.[6] The current evolutionary genetic view is that the evolution of new body plans is often driven by changes in gene expression, controlled by homeobox genes, with cis-regulatory elements regulating gene expressions modularly.[2,7] A new theme in evolutionary biology is that all major body plans had originated quite early on in evolution, in the (hypothetical) common ancestor of all bilaterian animals called *Urbilateria*. Since then, there have been relatively few innovations since. Moreover, many body plans are a result of gene loss, not gene acquisition.[8] Gene families for all basic body plans appeared miraculously at the beginning of the evolutionary process. Yet, for some unexplainable reason, however, evolution of newer gene families then ceased. A number of epigenetic and non-coding genetic elements are also conserved between cnidarians and vertebrates/bilaterians: chromatin marks, enhancer modifications, gene regulatory elements, and broad gene synteny.[9]

Triploblasty

According to some evolutionary views, early metazoans developed into mesodermate animals in a stepwise fashion with one, two, and then three germ layers. According to this view, cnidarians are a simpler group of organisms compared to bilaterian animals, which have three germ layers compared to the two layers of cnidarians. However, based on new discoveries, this view is now being overturned. Furthermore, diploblasty is seen by some to have evolved secondarily in cnidarian larvae and polyps.[10]

It turns out that cnidarians have been found to contain mesodermal and muscle tissues, along with myogenic regulatory genes.[11] A list of these genes can be seen in table 1.[10,12,13] These genes all have orthologs to bilaterian mesodermal or myogenic genes. Larval cnidarian cells, including gastrodermal and epithelial cells, also contain smooth muscle myofibre. A layer of cells is established at the beginning of the medusa stage, called the entocodon. In other species, an extracellular matrix wedged between the endoderm and ectoderm called the mesoglea also contains some scattered cells. The entocodon and mesoglea are considered by some to correspond to bilaterian mesoderm.[14] However, the mesenchymal entocodal mesoderm of hydromedusae have a separate three-dimensional structure. The bell of medusozoan jellyfish also contains mononucleated, non-fused striated muscle cells. Striated muscle originates from mesoderm-like primordia.

The cnidarian nervous system and sensory organs

Many genes are shared throughout the animal kingdom, and conserved genes and regulatory circuits are used differentially.[5,15,25] This is a roundabout way of saying that evolution didn't happen, since it is highly improbable that all major body plans would be conserved for all of evolutionary time. This is more consistent with creation, which states that all groups of organisms were created at the beginning of creation.

A prevailing evolutionary view of the cnidarian nervous system is that of a simple, diffuse neural network. However, this is based on the study of only a single freshwater *Hydra* species. Elements of the nervous system of more complex animals have been shown to be present in cnidarians. Such elements include mechanoreceptors, photoreceptors, chemoreceptors, neurotransmitters, motor neurons, and gangliar neurons. Homologous regulatory genes of the nervous system are present in cnidarians and bilaterians.[16] For example, members of the *Pax* and *Six* gene families have been found to have similar structure and gene expression to their homologs in higher metazoans.[17,19]

The cnidarian nervous system is made up of pervasive nerve plexes that form linear or circular tracts, and can differentiate into several subsystems with separate functions and physiological properties. Synapses are also present between ganglion neurons and sensory cells and epithelial muscular cells. Neurons expressing neuropeptides are expressed in a polarized way relative to the body axis.[18] Visually guided behavioural patterns can also be quite complex, including navigation and courting.

On the genetic level, the Anthozoa and Hydrozoa have genes homologous with bilaterian genes involved in neurogenesis, neural network formation, synaptic structure formation and transmission, vesicle formation, and axon pathfinding. These genes also include conserved transcription factors such as bHLH factors, type B *Sox* genes, zinc-finger proteins, and neuron-specific RNA binding proteins. Neurotransmitters and their receptors such as acetylcholine, catecholamine, GABA, epinephrine, and dopamine are also present in cnidarians.[17]

Rhopalia are interesting sensory organs, which are responsible for gathering photic information as well as keeping the organism in balance. Light-sensing organs in cnidaris can be as complex as camera eyes complete with lens as in *Cladonema* or *Tripedalia cystophora*;[19] cubozoans even have a cornea and ciliated photoreceptor cells.[20] The PaxB gene in *T. cystophora* is expressed in the jellyfish lens, retina, and statocyst, and can also induce small, ectopic eyes in *Drosophila*. This gene is highly similar to the *Pax6* gene in more complex organisms, which is responsible for regulating eye development.[21] They are club-shaped bodies located on the bell of the medusa of

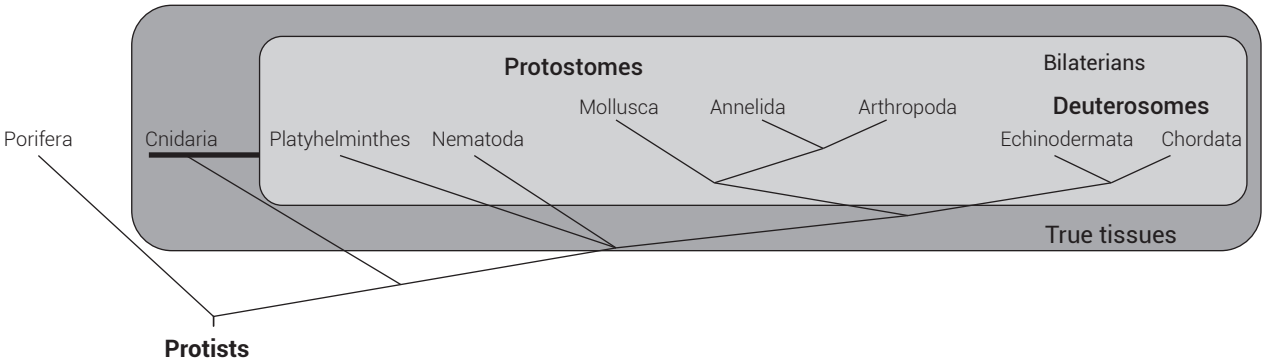

Figure 1. Phylogenetic tree depicting how evolutionists perceive the relationship between cnidarians and other animal phyla. Cnidarians are a sister group with bilaterians. They are deemed to have radial symmetry instead of two-sided symmetry. As compared to sponges (Porifera) they have true tissues (endoderm and ectoderm). This figure was reproduced based on figure I, from Technau *et al.*[39]. Choanoflagellates are not depicted, nor are the branch points for Urmetazoa, Ureumetazoa, and Urbilateria.

Table 1. List of genes from certain cnidarian species which take part in mesoderm formation, neurogenesis, and myogenesis in cnidarians (from Martindale *et al.*[10] and Seipel and Schmid[12]). Note: just because the gene is not expressed in the mesoderm doesn't mean that it does not induce mesoderm development.

Gene	Tissue	Function
Ash	Endoderm nematboblasts, nematocytes	Nematocyte induction, HLH transcription factor
Ash 2	Endoderm secretory cells, myogenesis	HLH transcription factor
Atl1	Entocodon, proneural	Secretory cell, muscle differentiation
Bagpipe	Endoderm	Mesoderm patterning and differentiation
Brachyury	Entocodon	Myogenesis
Gata	Entocodon, muscles, mesoderm	Blastula development, zinc-finger transcription factor
Id	Endoderm, muscles	HLH transcription factor
Mef2	Entocodon	Nematocyte induction, MADS-box transcription factor
Mox	Endoderm	Mesoderm patterning and differentiation
MRF	Entocodon, muscles	HLH transcription factor
Msx	Entocodon, neuronal	Myogenesis
NK-2	Endoderm	Peduncle formation, homeobox protein
Otx	Entocodon, muscles	Homeobox transcription factor
Snail	Entocodon, muscles	Gastrulation, gastrodermis and pharynx development, C2H2 transcription factor
Tinman	Endoderm	Mesoderm patterning and differentiation
Twist	Endoderm	Induction of neurons in pharynx, HLH transcription factor

schypozoans and cubozoans. Each rhopalium consists of a lithocyst, otherwise known as a statocyst at its terminal end, covered by a layer of epithelium. Underneath this is a mass of subepidermal ectodermal pigmented sensory cells. Underneath this lies a touch plate consisting of thickened epidermal sensory cells, which synapse with the diffuse nervous system and the motor nerve net. When the jellyfish is tilted, the heavy rhopalium induces asymmetric muscle contraction to straighten up the jellyfish.[22]

The main genes responsible for the formation of rhopalia are in the *Otx* and *POU* gene families, which are conserved also in vertebrates and other bilaterians and perform similar functions.[23] In *Nematostella*, three Otx genes (Otx A, B, and C) play a role as homeodomain transcription factors in the aboral and pharyngeal endoderm, as well as the tentacles. However, expression patterns of *Otx* genes in the jellyfish *Podocoryne* do not correlate to those in bilaterians, which came about independently, as expected by the creation model. All three genes are expressed in endodermal tissues surrounding the mouth cavity, such as in the circum-oral nerve ring in the bilaterian nervous system.[19, 24] In vertebrates the *POU* gene family is known as the Brn3 gene family, which code for transcription factors, and takes part in the development of sensory cells related to vision, hearing, and olfaction.

The nematocyte

The nematocyte is an organelle inside the specialized cnidarian cnidocyte cell which play a role in predation, defence, and locomotion. They can vary in shape and size, from 5–100 μm and 25–30 basic types. They first develop in cells called nematoblasts and then migrate to battery cells, usually located in the tentacles. The nematocyte looks basically like a cylinder with a tubule located inside, adorned with spines or other appendages. An extreme osmotic pressure of 150 bar builds up inside and is used to launch the nematocyte. When activated by mechanical pressure at the operculum, the nematocyte shoots out at a phenomenal acceleration of more than 5 million g! The expanding tubule then punctures the surface or skin of the prey/attacker and injects toxins into its system, thereby subduing it.[26] Nematocyte venoms also exhibit additional effects, such as cytolysis, dermatonecrosis, proteolysis, and vasopermeation.

Just like the flagellum of the bacterium, *E. coli*, the nematocyte is truly an example of irreducible complexity, one of the fastest biomechanical events in nature. Hundreds of genes are involved in making up its structure. Nematocytes themselves contain thousands of proteins, all specific to cnidarians and many of them are species-specific venoms. Most surprisingly, however, Rachamim

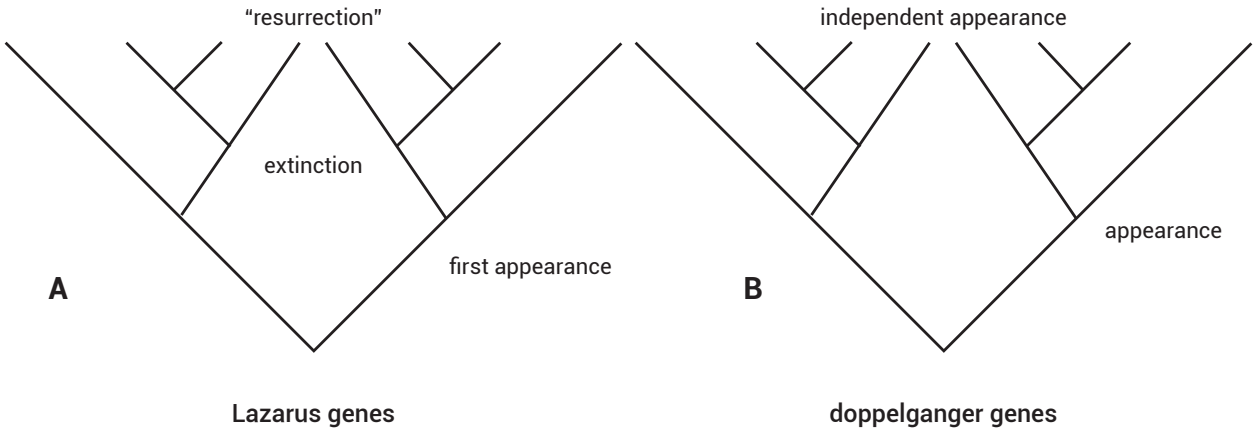

Figure 2. Phylogenetic trees depicting appearance of a hypothetical gene during evolution, followed by its extinction and 'resurrection' in Lazarus genes (part A). Two appearances of a hypothetical gene in two separate branches of the evolutionary tree, independently of each other. Such a gene may be slightly different in sequence or function in its two appearances.

et al. discovered that three diverse cnidarians (*Anemonia viridis*, *Aurelia aurita*, and *Hydra magnipapillata*) only have six proteins in common (see table 2).[27]

The picture presented of nematocyte development is surprising indeed, and definitely not expected if they arose through gradual genetic evolution. Many genes are specific to cnidarians,[28] which could only be explained by evolutionary theory if they arose through gene duplication followed by rapid successive divergence. Besides a lack of candidate ancestral genes from which these cnidarian genes have diverged—due to the nature of the genetic process involved, these newly cnidarian-specific genes must have been mutated beyond recognition— this process of duplication and divergence must also have happened on a grand scale, but specific only to cnidarians. It is much more simple to assume that duplication and divergence of so many cnidarian-specific genes actually did not take place, but that cnidarians, as a taxonomic group (an apobaramin[29]) were created separately from all other organisms. Such taxonomically restricted genes are quite common in different species and defy evolutionary explanations.[30]

Table 2. Six nematocyte proteins common to three cnidarian species (from Rachamim *et al.*[27])

Protein name	Function
Nematogalectin	Structural element of nematocyte tubule
Elongation Factor 1-alpha-like	Microtubule bundling and dissociation
Dickkopf	Neurotoxin; nematocyte differentiation
Heat Shock Protein 70	Protein folding for toxin proteins
Secreted protein	Unknown
Transmembrane protein	Unknown

Fossil jellyfish

Recently fibres and cellular structures have been discovered in supposedly 75-Ma-old dinosaur specimens by Bertazzo *et al*.[31] The article states that until recently, it has been widely accepted that protein molecules cannot survive more than 1 Ma.[32] However, Bertazzo *et al*. write that since the dinosaur fossils do not show signs of exceptional preservation, the ultrastructure of putative collagen fibres can last for even 75 Ma.

Cartwright *et al*. have discovered several fossil jellyfish from the Middle Cambrian from Utah representing hydrozoans, scyphozoans, and cubozoans, all considered to be within modern cnidarian classes.[33] Tentacles and muscles have been shown to be preserved among these specimens. Modern cubozoans, such as *Tripedalia cystophora* have complex nervous systems, eye structures, and possess organs involved in sperm transfer called spermatophores. Complex medusae have appeared at the latest by the Late Carboniferous (290 Ma), but possibly as early as the Late Ediacaran (543 Ma), such as a conulariid from the genus *Paraconularia*, or the scyphozoan, *Corumbella werneri*. Evolutionists note that:

> "One striking feature for all three classes, even when considering Palaeozoic forms, is *the general morphological similarity between fossil and living medusae; almost all well-preserved fossil medusae possess characters consistent with membership in extant groups* [emphasis added]."[34]

Many cnidarian groups can thus be considered to be living fossils. The natural consequence of this

statement is that cnidarians have not undergone significant evolution for hundreds of millions of years, since shortly after they were supposed to have evolved. In contrast, this fits in precisely with the creationist viewpoint which states that the cnidarian baramins were created and did not give rise to newer groups after their creation.

Resurrecting Lazarus genes

In paleontology, 'Lazarus' species are named as such because there is a large gap in their extent in the geological record.[35] The distribution of fossils of Lazarus species can be due to local extinctions or sampling artefacts. However, the picture we see in genetics is different since we should be able to trace the existence or non-existence of genes within any organism or species throughout evolutionary time. *Alx* genes are present in *Nematostella*, and only 'resurface' later in vertebrates, a sub-branch of the Bilateria, during the hypothesized course of evolution.[36] Thus, the *Alx* gene could be termed a 'Lazarus gene' due to its 'resurrection' in species far removed from *Nematostella*.

This causes a great problem for evolutionary theory, since one of the basic assumptions is that no gene can evolve more than once. This is because the universe of possible gene sequences is simply so large (4^{300}~ 10^{180} possible combinations if an average gene is 300 bp long) that the same sequence occurring randomly, by chance, is practically impossible. According to evolution, organisms change so much over time that it is virtually impossible for two species to follow the exact same evolutionary trajectory, especially if evolution is a blind, unguided process, 'tinkering away' with biological material, according to the famous evolutionist, François Jacob.[37] Figure 2, part A, depicts the appearance, extinction, and 'resurrection' of a hypothetical gene in a branch of the evolutionary tree.

Yet this is what we see in the case of a number of genes common to both *Nematostella* and vertebrates. Khalturin *et al*. write:

> "EST (expressed sequence tag) and genome data from the sea anemone *Nematostella vectensis* and the anthozoan coral *Acropora millepora* (all Cnidarians) revealed that basal metazoans possess most of the gene families found in bilaterians and have retained many ancestral genes that have been lost from *Drosophila* and *[Caenorhabditis] elegans*. Cnidarians, therefore, are much more 'human-like' than flies and worms in terms of their gene content."[38]

This study talks about how cnidarians possess one of the most complex cell types in the animal kingdom; the cnidocyte, or nematocyte, or 'stinging cell', which is used by the animal to capture food. Technau *et al*. go so far as to comment, "One such possible interpretation of the counterintuitive complexity of cnidarians could be that they are actually highly derived deuterostomes,"[39] but remember that this is contradicted by other phylogenetic data. Putnam *et al*. found that nearly two thirds of all human genes (13,830) as well as 12,319 *Nematostella* genes have arisen from the ancestral eumetazoan gene set, whereas only 7,309 have arisen in *Drosophila* and 7,261 in *Caenorhabditis elegans*.[40] This raises the question, how can organisms such as the fruit fly and the roundworm remain viable organisms, if they lose

Table 3. List of some Lazarus and doppelganger genes found in cnidarians and other species

Gene symbol	Function	Species
Lazarus genes		
Alx-1, 3, 4	Aristaless-like; homeodomain protein	*N. vectensis,* vertebrates
Wnt-2, 3, 4, 8, 11		
Dickkopf	Wnt antagonist	*Cyanea, Hydra*
OR genes	Odorant receptors	*N. vectensis, Hydra magnipapillata,* cephalocordates, vertebrates
Cytovec	Cytoplasmic ADP-Intermediate filament protein	*N. vectensis,* vertebrates
Djnlg	Noggin homolog, induces neural tissue	*Dugesia japonica,* vertebrates
Doppelganger genes		
ADP-ribosyl cyclase	Intracellular calcium mobilizer, signal transduction	*Eudendrium racemosum, Euglena*
APX1	Ascorbate peroxidase	*Hydra* species, *Chlorella*
CaMKII	Long-term memory	*Dugesia japonica, Arabidopsis,* yeast
VDAC	Mitochondrial respiration; voltage-dependent anion channel	Yeast, Metazoa

so much of their genome? Genome decay produces only less viable species, as seen in bacterial genome decay.[41]

Indeed, besides *Alx*, hundreds of other Lazarus genes exist in cnidarians and other species at the base of the evolutionary tree. Miller and Ball report that genes in common between *Nematostella* and humans are nearly twice as numerous as between fly, worm, and human.[42,43] Observable 'ancient complexity' does not make sense in the light of evolution, yet makes perfect sense in the light of creation theory: each created kind, or baramin, was created with inherent genetic and morphological complexity, with subsequent gene loss over time, as a result of devolutionary processes due to the Fall. For an overview of some of these genes, see table 3. Indeed, Technau *et al*. report some 318 genes from *Nematostella*, and 196 from *Acropora* which have been detected in vertebrates at an e-score level of 10^{-10}, but did not even score 10^{-4} in ecdyzoans (arthropods and nematodes).[39] Other such examples include the *Wnt* gene family, where five members (*Wnt*-2, 3, 4, 8, and 11) occur in *Nematostella* but not in ecdyzoans (a subset of the protostomes).[44,45] Examples of vertebrate genes in other cnidarian species include the *Wnt* antagonist, *Dickkopf*, present in the jellyfish, *Cyanea capillata*,[46] and the bone morphogenic protein (*BMP*) antagonist in invertebrate species, such as the sponge *Suberites*.[47] *OR* genes also occur in cephalocordates, vertebrates, and the hydrozoan *Hydra magnipapillata* and the cnidarian *N. vectensis*. *OR* genes play a role in cellular migration in several invertebrate species.[48] A lamin gene called *cytovec* occurs in *N. vectensis* and in vertebrates, and plays a role in cytoskeleton formation. The *cytovec* gene is the most similar to intermediate filament genes from another cnidarian, *Clytia hemispherica*, and a *nematocilin* A and B from *Hydra vulgaris*.[49]

Doppelganger genes

Even more interesting are genes which occur in cnidarians and non-metazoans, such as plant species. Whereas Lazarus genes are supposedly 'resurrected' in later species in the lineage of species derived from cnidarians, *doppelganger* genes occur in completely different domains of life. Here again, the probability of the same gene arising twice through random evolutionary tinkering is beyond possibility. Figure 2, part B, depicts how a hypothetical gene arises by chance in two separate regions of the evolutionary tree, independently from one another. Such genes might be slightly different in sequence or in function.

For example, the ADP-ribosyl cyclase gene occurs in *Euglena*, where it undergoes light-induced regulation. In sponges, along with ABA it mediates temperature signalling. In the hydra *Eudendrium racemosum* it induces regeneration in the dark. *ABA* is also present in mammals and may induce cell proliferation.[50] Another doppelganger gene, *HvAPX1* functions as an ascorbate peroxidase, which plays a protectant role during oogenesis in *Hydra*.[51] Evolutionary theory states that this gene was transferred to *Hydra* via horizontal gene transfer from an ancient endosymbiont. This, however, is contradicted by the fact that the *APX1* gene in plants contains introns, whereas *HvAPX1* is intronless. Since the two genes have a different structure, they must also have separate origins. Further intriguing is the presence of *APX* genes in trypanosomes, which are more similar to plant sequences than animal sequences.[52] Since trypanosomes are single-celled parasites, they cannot contain plant endosymbionts. Thus the chance of horizontal gene transfer is negligible. This study is just one of many phylogenetic analyses which show that the topology of the eukaryotic phylogenetic tree is inconsistent. A full 26% of human and *Nematostella* introns are conserved with *Arabidopsis thaliana* (a plant) and 24% with *Cryptococcus* (a fungi). Interestingly, a number of genes involved in the central nervous system have been discovered not only in the planarian, *Dugesia japonica*, and vertebrates, but also in yeast and *Arabidopsis*, which are organisms without any kind of nervous system! These genes include the planarian homolog of *noggin*, *Djnlg*, as well as *CaMKII*, which is essential for long-term memory in animals.[53] In order for evolution to be even remotely possible, these genes must have had a meaningful function in single-celled organisms, and then stay conserved for 1,700 Ma. Of course, long-term memory in single-celled organisms is simply meaningless. The nervous system deals with signals transmitted over a range of different kinds of neurons; single-celled organisms do not have any other cell to transmit any kind of signal to.

Figure 3 shows a multiple alignment of the 265 aa long protein kinase domain common to five species which have the *CaMKII* gene. The high homology of doppelganger genes might pertain only to individual domains. Here the average amino acid identity between these five species for this protein is 54%. Koonin *et al*.[54] state for example that 80% identity between two sequences over 100 aa is very high homology. Yet, even a 43% identity in the lysozyme protein between goose and mouse is also high enough to recognize homology.

Non-coding doppelganger genetic elements

Lazarus elements are also present in non-coding regions of the genome, for example micro-RNA (miRNA). According to evolutionists, miRNA elements had independent origin in plants, animals, and fungi.[55] No recognizable miRNAs exist in Placozoans, which are simple organisms with only a few different types of cells, and only several cell layers thick. The sizes of miRNA elements are also different between cnidarians, poriferans, and

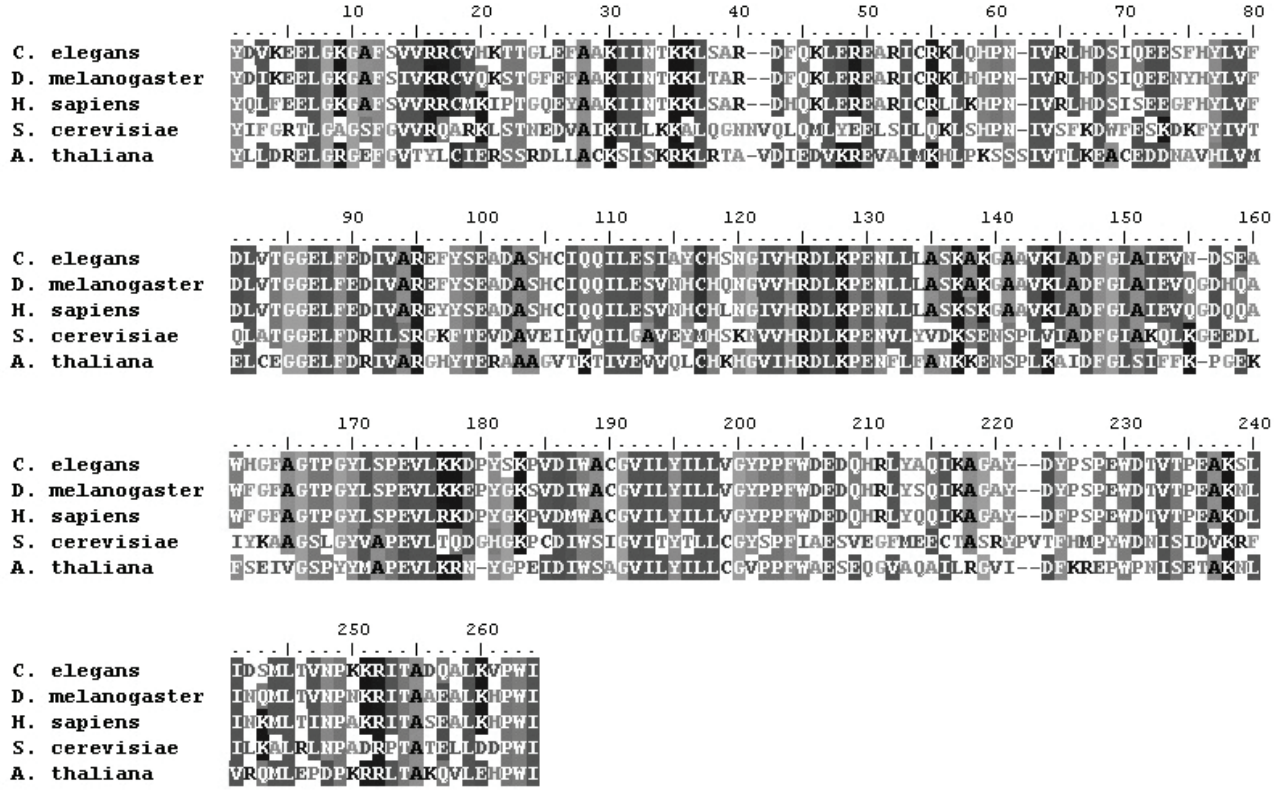

Figure 3. Multiple alignment of the protein kinase domain from the CaMKII (calcium/calmodulin-dependent protein kinase type II) gene from *Caenorhabditis elegans* (O62305.2), *Drosophila melanogaster* (Q00168.1), human (Q13557.3), *Saccharomyces cerevisiae* (P22517.2), and *Arabidopsis thaliana* (Q8W4I7.2).

bilaterians, implying discontinuity between these separate apobaramins. *Nematostella* miRNAs also direct splicing of their mRNA targets, which is different from bilaterian miRNAs.[56] Evolution would posit that miRNAs thus had evolved independently in Cnidaria and Bilateria,[57] yet the extreme improbability of this happening gives more support to separate creation of these apobaramins.

In cnidarians, along with a large part of their genes, miRNAs are highly taxonomically restricted. *N. vectensis* has only one of its 40 miRNAs in common with Bilateria, miR-100 (which even has different gene targets), whereas none of the 126 miRNAs of *Hydra magnipapillata* are in common with bilaterians. Although not all elements of the miRNA processing pathway are present in cnidarians, core elements are present, such as *Drosha*, *Pasha*, and *Dicer*, the last one of which is present in multiple copies. Moran *et al.* even report from a study of 87 *Nematostella* miRNAs that only two of them are conserved across the Cnidaria itself.[58–60]

An example of a doppelganger gene involved in miRNA biogenesis is *HYL1*. It was previously thought only to occur in plants, but recently its homolog was discovered in cnidarians and other non-bilaterians, as well as fungi.[48,49]

The phenomenon of trans-splicing

Another case of Lazarus elements appearing in several animal phyla is that of trans-splicing of genes. As opposed to regular cis-splicing where exons are differentially excised out of a single gene, trans-splicing involves joining sequences from different locations, forming a hybrid mRNA molecule. Genes which are trans-spliced contain a characteristic SL sequence. Trans-splicing involves most of the regular splicing machinery, except for the *U1 snRNP*, and also uses similar splice donor and acceptor sites, making cis-splicing and trans-splicing closely related.[61] Indeed, evolutionists argue that trans-splicing could have arisen quite easily during evolution. The process would involve changing a few bases to form a new acceptor/donor splice site, which occurs rather quickly.[53]

However, the phylogenetic distribution of trans-splicing argues against the evolution of these genetic elements. Despite the possibility of quick evolution, trans-splicing has only been recognized in a smaller number of organisms: euglenazoans, dinoflagellates, hydrozoan cnidarians, nematodes, flatworms, bdelloid rotifers, chaetognaths, and urochordates. Interestingly, in trypanosomes, all mRNAs undergo trans-splicing.[62,63] Genes evolving in pairs as a functional unit make the scenario more difficult

for evolution, since it would have to explain how genes coordinate their evolution with each other, similar to the problem of how bidirectional promoters (which are promoter sequences nested in between two genes on opposite strands) came about.

The emergence of trans-splicing is fast, evolutionarily speaking, yet it is restricted to only a few animal groups, from single-celled organisms to urochordates. It is supposed to have arisen separately in Lazarus-like fashion, according to EST data matching the SL motif (in ctenophores, hydrozoans, urochordates, and some protostomes).[55] One would expect that if trans-splicing is such a rapid evolutionary process, lower organisms would have more trans-spliced mRNAs, compared to higher organisms, which would have proportionately less, according to their complexity. Rapid processes present in only a few entities correlate with younger ages of those entities, and not evolutionarily long ages.

Conclusion

Cnidarians are wonderful creations of God. Despite evolutionary assumptions, these organisms are relatively complex, both morphologically and genetically. Genetic complexity has traditionally been assumed to have arisen much later in animal evolution, but is now considered to be an ancestral feature.[17] Thus, animal diversity is largely based on differential use of conserved genes and regulatory circuits. Conservation of genes responsible for the basic body plan of organisms throughout evolution actually disproves it.[64] The long-held view that cnidarians are also simple, diploblastic organisms is also being overturned, as these organisms have been shown to have mesoderm and also a relatively complex nervous system.

Moreover, not only genes but their cis-regulatory elements are also very similar in cnidarians and bilaterians.[9] Thus the picture seems to be that different organismal phenotypes are fundamentally defined by the genetic context that the genes are in. Cnidarians also defy evolution by the preservation of their soft tissue over periods of time longer than the dinosaurs. Preservation of jellyfish tissue over such supposed long periods of time is thus highly improbable. Fossil medusae are also very similar in morphology to extant species, implying that no evolution took place over hundreds of millions of years, and include many 'living fossil' species.

Furthermore, the genetics of cnidarians is also fascinating. The evolutionarily impossible event of hundreds of genes (called Lazarus and doppelganger genes) appearing, disappearing, then reappearing over the course of eons and innumerable genetic steps disproves evolution on strictly Darwinian terms. Evolution dogmatically states that thousands of homologous genes are common to *Nematostella* and vertebrates, yet are missing from flies and worms (ecdyzoans). It is much simpler to state (via Occam's razor) that these genes didn't actually disappear from ecdyzoans, but rather that separate and distinct sets of genes are responsible for the morphology of different groups (apobaramins) of animals (cnidarians, flies, worms, and vertebrates).

All of these considerations present a picture much more compatible with creation rather than evolution.

Materials and methods

Figure 1 was made with the Phylodendron tree-making software at iubio.bio.indiana.edu/treeapp/treeprint-sample1.html. Tree data for animal phyla was entered in Newick format. Figure 3 was made in BioEdit.[65]

References

1. Daly, M., Brugler, M.R. and Cartwright, P. *et al.*, The phylum Cnidaria: A review of phylogenetic patterns and diversity 300 years after Linnaeus; in: Zhang, Z.-Q. and Shear, W.A. (Eds.), Linnaeus Tercentenary: Progress in Invertebrate Taxonomy, Zootaxa, 1668, Magnolia Press, Auckland, New Zealand, pp. 127–182, 2007.
2. Technau, U. and Steele, R.E., Evolutionary crossroads in developmental biology: Cnidaria, *Development* **138**(8):1447–1458, 2011.
3. Watanabe, H., Fujisawa, T. and Holstein, T.W., Cnidarians and the evolutionary origin of the nervous system, *Dev. Growth Differ.* **51**(3):167–183, 2009.
4. Van Iten, H., Marques, A.C., De Moraes Leme, J., Pacheco, M.L.A.F. and Simoes, M.G, Origin and early diversification of the phylum Cnidaria Verrill: major developments in the analysis of the taxon's Proterozoic-Cambrian history, *Palaeontology* 57(4).:1–14, 2014.
5. Boero, F., Schierwater, B. and Piraino, S., Cnidarian milestones in metazoan evolution, *Integr. Comp. Biol.* **47**(5):693–700, 2007.
6. Ryan, J.F., Burton, P.M. and Mazza, M.E. *et al.*, The cnidarian-bilaterian ancestor possessed at least 56 homeoboxes: evidence from the starlet sea anemone, *Nematostella vectensis*, *Genome Biol.* **7**(7):R64, 2006.
7. Frankel, N., Wang, S. and Stern, D.L., Conserved regulatory architecture underlies parallel genetic changes and convergent phenotypic evolution, *Proc. Natl Acad. Sci. USA* **109**(51):20975–20979, 2012.
8. De Robertis, E.M., Evo-devo: variations on ancestral themes, *Cell* **132**(2): 185–195, 2008.
9. Schwaiger, M., Schönaue, A. and Rendeiro, A.F. *et al.*, Evolutionary conservation of the eumetazoan gene regulatory landscape, *Genome Res.* **24**(4): 639–650, 2014.
10. Martindale, M.Q., Pang, K. and Finnerty, J.R., Investigating the origins of triploblasty: 'mesodermal' gene expression in a diploblastic animal, the sea anemone Nematostella vectensis (phylum, Cnidaria; class, Anthozoa), *Developmen*t **131**(10):2463–2474, 2004.
11. Seipel, K. and Schmid, V., Mesodermal anatomies in cnidarian polyps and medusa, *Int. J. Dev. Biol.* **50**(7):589–99, 2006.
12. Seipel, K. and Schmid, V., Evolution of striated muscle: jellyfish and the origin of triploblasty, *Dev. Biol.* **282**(1):14–26, 2005.
13. Technau, U. and Scholz, C.B., Origin and evolution of endoderm and mesoderm, *Int. J. Dev. Biol.* **47**(7–8):531–9, 2003.
14. Müller, P., Seipel, K., Yanze, N. *et al.*, Evolutionary aspects of developmentally regulated helix-loop-helix transcription factors in striated muscle of jellyfish, *Dev. Biol.* **255**(2):216–229, 2003.
15. Carroll, S.B., Evo-devo and an expanding evolutionary synthesis: a genetic theory of morphological evolution, *Cell* **134**(1):25–36, 2008.
16. Miljkovic-Licina, M., Gauchat, D. and Galliot, B., Neuronal evolution: analysis of regulatory genes in a first-evolved nervous system, the hydra nervous system, *Biosystems* **76**(1–3):75–87, 2004.

17. Gehring, W.J., New perspectives on eye development and the evolution of eyes and photoreceptors, *J. Hered.* **96**(3):171–84, 2005.
18. Watanabe, H., Fujisawa, T. and Holstein, T.W., Cnidarians and the evolutionary origin of the nervous system, *Dev. Growth Differ.* **51**(3):167–183, 2009.
19. Piatigorsky, J., Horwitz, J., Kuwabara, T. and Cutress, C.E., The cellular eye lens and crystallins of cubomedusan jellyfish, *J. Comp. Physiol. A* **164**(5): 577–587, 1989.
20. Galliot, B., Quiquand, M. and Ghila, L. *et al.*, Origins of neurogenesis, a cnidarian view, *Dev. Biol.* **332**(1):2–24, 2009.
21. Kozmik, Z., Daube, M. and Frei, E. *et al.*, Role of Pax genes in eye evolution: a cnidarian PaxB gene uniting Pax2 and Pax6 functions, *Dev. Cell.* **5**(5): 773–785, 2003.
22. Nakanishi, N., Hartenstein, V. and Jacobs, D.K., Development of the rhopalial nervous system in *Aurelia* sp.1 (Cnidaria, Scyphozoa), *Dev. Genes Evol.* **219**(6): 301–317, 2009.
23. Nakanishi, N., Yuan, D., Hartenstein, V. and Jacobs, D.K., Evolutionary origin of rhopalia: insights from cellular-level analyses of Otx and POU expression patterns in the developing rhopalial nervous system, *Evol. Dev.* **12**(4): 404–415, 2010.
24. Mazza, M.E., Pang, K., Martindale, M.Q. and Finnerty, J.R., Genomic organization, gene structure, and developmental expression of three clustered otx genes in the sea anemone Nematostella vectensis, *J. Exp. Zool. B Mol. Dev. Evol.* **308**(4):494–506, 2007.
25. Candiani, S., Oliveri, D. and Parodi, M. et al., Expression of AmphiPOU-IV in the developing neural tube and epidermal sensory neural precursors in amphioxus supports a conserved role of class IV POU genes in the sensory cells development, Dev. Genes. Evol. 216(10):623–633, 2006.
26. Beckmann, A. and Özbek, S., The nematocyte: a molecular map of the cnidarian stinging organelle, Int. J. Dev. Biol. 56(6–8):577–582, 2012.
27. Rachamim, T., Morgenstern, D. and Aharonovich, D. *et al.*, The dynamically evolving nematocyst content of an anthozoan, a scyphozoan, and a hydrozoan, *Mol. Biol. Evol.* **32**(3):740–753, 2015.
28. Milde, S., Hemmrich, G. and Anton-Erxleben, F. *et al.*, Characterization of taxonomically restricted genes in a phylum-restricted cell type, *Genome Biol.* **10**(1): R8, 2009.
29. Frair, W., Baraminology – Classification of Created Organisms, *CRSQ* **37**(2): 82–91, 2000.
30. Tomkins, J. and Bergman, J. Incomplete lineage sorting and other 'rogue' data fell the tree of life, *J. Creation* **27**(3):84–92, 2013.
31. Bertazzo, S., Maidment, S.C. and Kallepitis, C. *et al.*, Fibres and cellular structures preserved in 75-million-year-old dinosaur specimens, *Nat. Commun.* **6**:7352, 2015.
32. Schweitzer, M.H., Zheng, W. and Cleland, T.P. *et al.*, A role for iron and oxygen chemistry in preserving soft tissues, cells and molecules from deep time, *Proc. Biol. Sci.* **281**(1775):20132741, 2013.
33. Cartwright, P., Halgedahl, S.L. and Hendricks, J.R., *et al.* Exceptionally Preserved Jellyfishes from the Middle Cambrian, Humphries S (Ed.), *PLoS ONE*. **2**(10):e1121, 2007.
34. Catchpoole, D. Hundreds of jellyfish fossils! *Creation* **25**(4):32–33, 2003.
35. Wignall, P.B., Lazarus taxa and fossil abundance at times of biotic crisis, *J. Geological Society* **156**(3):453, 1999.
36. McGonnell, I.M., Graham, A. and Richardson, J. *et al.*, Evolution of the Alx homeobox gene family: parallel retention and independent loss of the vertebrate Alx3 gene, *Evol. Dev.* **13**(4):343–351, 2011.
37. Jacob, F., Evolution and tinkering, *Science* **196**(4295):1161–1166, 1977.
38. Khalturin, K., Hemmrich, G. and Fraune, S. *et al.*, More than just orphans: are taxonomically-restricted genes important in evolution? *Trends Genet.* **25**(9): 404–413, 2009.
39. Technau, U., Rudd, S., Maxwell, P. *et al.*, Maintenance of ancestral complexity and non-metazoan genes in two basal cnidarians, *Trends Genet.* **21**(12):633–639, 2005.
40. Putnam, N.H., Srivastava, M. and Hellsten, U. *et al.*, Sea anemone genome reveals ancestral eumetazoan gene repertoire and genomic organization, *Science* **317**(5834):86–94, 2007.
41. O'Micks, J., Bacterial genome decay from a baraminological viewpoint, *J. Creation* **29**(2):110–118, 2015.
42. Miller, D.J. and Ball, E.E., Cryptic complexity captured: the Nematostella genome reveals its secrets, *Trends Genet.* **24**(1):1–4, 2008.
43. Ball, E.E., Hayward, D.C., Saint, R. and Miller, D.J., A simple plan—cnidarians and the origins of developmental mechanisms, *Nat. Rev. Genet.* **5**(8): 567–577, 2004.
44. Kusserow, A., Pang, K. and Sturm, C. *et al.*, Unexpected complexity of the Wnt gene family in a sea anemone, *Nature* **433**(7022):156–160, 2005.
45. Miller, D.J., Ball, E.E., and Technau, U., Cnidarians and ancestral genetic complexity in the animal kingdom, *Trends Genet.* **21**(10):536–539, 2005.
46. Yang, Y., Cun, S. and Xie, X. *et al.*, EST analysis of gene expression in the tentacle of Cyanea capillata, *FEBS Lett.* **538**(1–3):183–191, 2003.
47. Müller, W.E., Korzhev, M. and Le Pennec, G. *et al.*, Origin of metazoan stem cell system in sponges: first approach to establish the model (Suberites domuncula), *Biomol. Eng.* **20**(4–6):369–379, 2003.
48. Churcher, A.M. and Taylor, J.S., The antiquity of chordate odorant receptors is revealed by the discovery of orthologs in the cnidarian Nematostella vectensis, *Genome Biol. Evol.* **3**:36–43, 2011.
49. Zimek, A., Thiering, S., Weber, K. and Magin, T.M., Genes encoding cytoplasmic intermediate filament proteins of vertebrates revisited: identification of a cytoplasmic intermediate filament protein in the sea anemone Nematostella, *Eur. J. Cell Biol.* **91**(10):809–817, 2012.
50. Puce, S., Basile, G. and Bavestrello, G. *et al.*, Abscisic acid signaling through cyclic ADP-ribose in hydroid regeneration, *J. Biol. Chem.* **279**(38): 39783–39788, 2004.
51. Habetha, M. and Bosch, T.C., Symbiotic Hydra express a plant-like peroxidase gene during oogenesis, *J. Exp. Biol.* **208**(11):2157–2165, 2005.
52. Löytynoja, A. and Milinkovitch, M.C., Molecular phylogenetic analyses of the mitochondrial ADP-ATP carriers: the Plantae/Fungi/Metazoa trichotomy revisited, *Proc. Natl Acad. Sci. USA* **98**(18):10202–10207, 2001.
53. Mineta, K., Nakazawa, M. and Cebria, F. *et al.*, Origin and evolutionary process of the CNS elucidated by comparative genomics analysis of planarian ESTs, *Proc. Natl Acad. Sci. USA* **100**(13):7666–7671, 2003.
54. Koonin, E.V. and Galperin, M.Y., Sequence–evolution–function: computational approaches in comparative genomics, chap. 2; in: *Evolutionary Concept in Genetics and Genomics*, Kluwer Academic, Boston, MA, 2003.
55. Arneigh, M.R., It's a small world—microRNA cuts evolution down to size, *J. Creation* **27**(2):85–90, 2013.
56. Jones-Rhoades, M.W., Bartel, D.P. and Bartel, B., MicroRNAS and their regulatory roles in plants, *Annu. Rev. Plant Biol.* **57**:19–53, 2006.
57. Moran, Y., Fredman, D. and Praher, D. *et al.*, Cnidarian microRNAs frequently regulate targets by cleavage, *Genome Res.* **24**(4):651–663, 2014.
58. Moran, Y., Praher, D., Fredman, D. and Technau, U., The evolution of microRNA pathway protein components in Cnidaria, *Mol. Biol. Evol.* **30**(12): 2541–2552, 2013.
59. de Jong, D., Eitel, M. and Jakob, W. *et al.*, Multiple dicer genes in the early-diverging metazoan, *Mol. Biol. Evol.* **26**(6):1333–1340, 2009.
60. Grimson, A., Srivastava, M. and Fahey, B. *et al.*, Early origins and evolution of microRNAs and Piwi-interacting RNAs in animals, *Nature* **455**(7217): 1193–1197, 2008.
61. Douris, V., Telford, M.J. and Averof, M., Evidence for multiple independent origins of trans-splicing in Metazoa, *Mol. Biol. Evol.* **27**(3):684–693, 2010.
62. Sutton, R.E. and Boothroyd, J.C., Evidence for trans splicing in trypanosomes, *Cell* **47**(4):527–535, 1986.
63. Derelle, R., Momose, T. and Manuel, M. *et al.*, Convergent origins and rapid evolution of spliced leader trans-splicing in metazoa: insights from the ctenophora and hydrozoa, *RNA* **16**(4):696–707, 2010.
64. Cserhati, M., Creation aspects of conserved non-coding sequences, *J. Creation* **21**(2):101–108, 2007.
65. Hall, T.A., BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT, *Nucleic Acids Symposium Series* **41**: 95–98, 1999.

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Nylon-eating bacteria—part 4: interpretation according to Coded Information System theory

Royal Truman

Three novel enzymes, E-I, E-II, and E-III can hydrolyze amide bonds of side-products from the manufacture of nylon-6. This has been incorrectly interpreted as proof for evolution, meaning descent of all organisms from a common ancestor, since they had not existed before. We evaluate the origin of these enzyme variants with Coded Information System (CIS) theory, which describes logic processing using four refinement components: coded messages, sensors, physical hardware and pre-loaded resources. Since after the completion of Creation Day 6 God rested, the individual organisms, and ecologies produced so far had to be adaptable to new contingencies in real time and across generations. This implies that they were created as open programs based on general and flexible principles and not hard-coded instructions limited to solving individual challenges. The ability to fine-tune enzymes such as E-I, E-II, and E-III to permit catalyzing reactions in a modified chemical context is a natural consequence of an open program design.

In part 1,[1] part 2,[2] and part 3[3] of this series we reviewed the origin of three classes of enzymes, E-I, E-II, and E-III, found in different bacteria which can degrade various synthetic side-products which result from the manufacture of nylon-6.[4] In part 3 we saw that these enzymes probably arose via mutations from a different enzyme. Is this an example of information having arisen for free, *contra* what Dembski[5] and so many others have claimed?

Significance of the origin of enzymes E-I, E-II, and E-III

How significant is the origin of these three enzymes, able to process a slightly different amide group? The precise three-dimensional chemical context of biological amide bonds which are enzymatically hydrolyzed varies greatly (arrangement of the atoms in space, charge distribution, other interfering portions of the molecule, and so on). Very different temperatures and viscosities also affect the local environments dramatically and further increase the challenges amidases[6] face. Not every naturally occurring amidase can hydrolyze every amide, but the ensemble of these enzymes can process all, or virtually all, of the naturally occurring amides found in biochemicals. The individual enzymes needed to process every substrate variant a prokaryote could encounter in the distant future would not have to be present initially on each individual, if a few optimizing mutations would easily provide these modified enzymes later while the population sizes grew, and the modified genes could be shared around.

The chemical context of the amide bonds being degraded in some side-products from nylon-6 manufacture differs but little from natural amides. Thus, obtaining a suitable amidase turns out to be reasonably probable, especially if it only needs to possess limited activity initially.

Anderson and Purdom point out that "a wide range of mutations can be shown to provide a beneficial phenotype to the cell"[7] but also that these mutations "frequently eliminate or reduce pre-existing cellular systems and functions. This has been referred to as antagonistic pleiotropy".

For higher organisms, Dr Borger introduced the idea of front-loaded baranomes—pluripotent, undifferentiated genomes with an intrinsic ability for rapid adaptation and speciation.[8,9] Life was not intended to be static, but adaptable and robust within limits to future challenges. Adaptability is often foolishly claimed to demonstrate evolution theory is true.[10] Evolution assumes all living organisms on earth share a common ancestor. Adaptability does not demonstrate anything of the kind.

Optimization of E-I, E-II, and E-III through selective iteration

Weren't enzymes E-I, E-II, and E-III optimized by natural selection? Again, we must keep in mind what was reported and thus needs explaining.[3] Existing genes were apparently modified in a few key positions, fine-tuning an enzymatic reaction—amide hydrolysis—which was already widespread in nature. Intelligent beings like humans excel in designing guided search algorithms which rely on repeated attempts. A process with suitable constraints is set up, typically conceived around the intuition of iteratively approaching the goal in response to some feedback. Examples include the simplex algorithm to solve linear programming problems,[11] genetic algorithms,[12] the Newton–Raphson method to find roots of equations,[13] and forward and backward chaining in inference engines.[14]

To illustrate adaptive exploratory behaviour, a hunter does not design a specific weapon to target each kind of bird for every environment, but uses a general-purpose one, like a shotgun, able to cover the range of feasible outcomes on an *ad hoc* basis. Feedback after the first shot permits a better subsequent attempt. The number of pellets, amount of gun powder in a shell, the length of the barrel, etc. were optimized in anticipation of a *category of problem* to be solved (hunting birds).

Other examples include the use of a watering can with multiple streams of waters (figure 1) and filters of various sizes to separate stones according to size (filters also have wide application in chemical and biochemical laboratories). Although the outcome may seem in a sense to be random (with respect to the precise results), the equipment and adjustments made as feedback becomes available are not random, revealing that these are guided searches. The randomness of outcomes is deliberately and steadily constrained. Dembski has shown that the guiding informational input necessary to find the correct search algorithm plus parameters cannot be less than the resulting outcome.[15]

Since bacteria play important ecological roles and must recycle countless kinds of substances, their genomes were created to cover a large number and variety of problems, adapting as needed. Their robustness permits them to flourish virtually everywhere on earth where life would be possible, providing the foundation for more complex organisms. Bacteria have been constrained to permit valuable, but not unlimited, variability. The typically low average mutational rates[16] and robustness to change permit viable mutations to occur while avoiding runaway genetic entropy, and the large populations plus short generation times permit a generous number of trials to be made.[17] This is an ideal setup, a problem-solving algorithm. In CIS terms, we can use as a reference state what would happen if the population sizes were dramatically smaller (not enough opportunities for a fortuitous mutation), or if mutation rates were much greater (error cascade results) or much lower (no adaptability results during the needed time frame).[18,19]

A portion of the original bacterial population forced into an environment where survival depends upon being able to process a new nutrient will typically result in a strain which has been degraded with respect to the more robust and general-purpose ancestral one, but it survives. Should the nutritional constraint be removed, the now inferior strain would typically be at a selective disadvantage and die out, permitting a different strain or a more robust and less specialized one to fill the emptied niche.[20] In this manner, by the combination of large populations, short generation times, and a low rate of mutation, short-term fine-tuning can occur while avoiding runaway DNA degradation.

Figure 1. Watering can as an example of a general purpose solution. A single design can be used to water different objects at various times and locations. This is an adaptable design where feedback permits iterative refinement. Evolution has no future, long-term goal and cannot ensure in advance that the necessary instructions and physical components will be integrated into a flexible system. The water can illustrates how for intelligently adaptable systems this is different: water is made available at a suitable location, a sensible number of streams run in parallel, the volume of water and range of variability during attempts make sense, feedback is readily fed into the improvement cycles, and so on.

Coded Information Systems theory to explain biology

CIS theory[18,19,21,22] clarifies how these kinds of designs work by identifying four generic *refinement components*: coded messages, sensors, physical hardware, and pre-loaded resources (which includes the ability to reason).[23] The solution architecture takes tradeoffs and interplay of these informational resources into account. Figure 2 shows a key insight of CIS theory, that first a variety of outcomes must become possible and then the diversity of outcomes is restricted when compared to a reference state lacking the refining component. Goal states are restricted compared to what would have been possible.

To understand Coded Information Systems we recommend determining which kind of sender-receiver design is being examined at a particular level of refinement (figure 2) towards the goal. One version responds mostly *mechanically* to informational resources. The other requires active, mostly *conscious cognitive processing.* CISs are usually

hierarchically embedded and both design variants are present in higher organisms. The human mind can decide on a course of action at a higher level which feeds into a cascade of automated subsystems such as mitochondria which generate the necessary energy. It remains to be researched whether it is always possible to clearly separate conceptually active and passive layers of information processing in CISs,[23] such as reports of mind-over-matter.[24]

Once one understands how CISs rely on the hierarchical and integrated interplay of complex resources (one of which must always include coded messages), the pieces begin to fall into place. The theory is quantitative, focusing on functional outcomes and not gene sequence similarities. Each step in the refinement process organizes matter and energy, making its own H_{before}–H_{after} contribution to the total of the CIS.

Since CIS theoreticians believe adaptability and fine-tuning were designed, we predict focused research will show that more than random processes are involved. We anticipate factors will be discovered which help guide change into promising areas especially for important environmental members such as prokaryotes.[25]

CIS theory forces us to look beyond DNA

CIS theory denies that processes such as development and regulation are specified by only the DNA sequences. There is no fully specified blueprint to be found there. This should not surprise us, since this is also true of most activities associated with intelligent behaviour. Our decisions and thoughts are not pre-programmed, nor do we communicate using only coded messages.

An intelligent sender, like a person, anticipates what the receiver already knows or might do when presented with various inputs, taking the immediate context into account. A driving instructor might point leftward, and thereby elicit the correct behaviour for the current situation (turn left at the street light; or adjust for the other car they are too close to; or roll down the window to order food at a drive-in; or admire the sunset). A less abstract gesture, like pushing someone, could anticipate and elicit a wide variety of responses, none of which required agreement to a sender-receiver coding convention nor grammar in advance. Logic and reasoning are pre-loaded resources which intelligent sender-receiver communicators avail themselves of.

Similarly, by knowing in advance the context organisms will face and the natural physical-chemical behaviour of molecules in cellular environments (e.g. diffusion rates of regulators; which biomolecules will interact and how; the presence and wavelength of light) the Creator can ensure intended outcomes (timing, quantity, location) by supplementing only as needed with any of the four refinement components. Most of the intended outcomes are not knowable from analysis of DNA only. In fact, many biologists view DNA as primarily responding to the true informational drivers provided by the cytoplasm. Much of development seems to the atheist to occur by chance interactions,[26] since they overlook the usage of foresight, how existing parts brought together must act, with informational additions provided as needed. Foresight includes knowing which possible solutions would not work, such as when a potential binding factor would interact with wrong DNA sequences throughout the entire genome and thus cannot be used. Evolutionists inevitably overlook the difficulty of creating macro innovation by trial-and-error with natural selection operating on the whole organism level.

Sophisticated Coded Information Systems are adaptable

Modern chess-playing computer programs often confront new positions never seen before yet provide excellent moves (figure 3). This is because the programs are endowed with general-purpose rules instead of hard-coded instructions which respond to each unique move (i.e. a decision tree). Whether new information arises

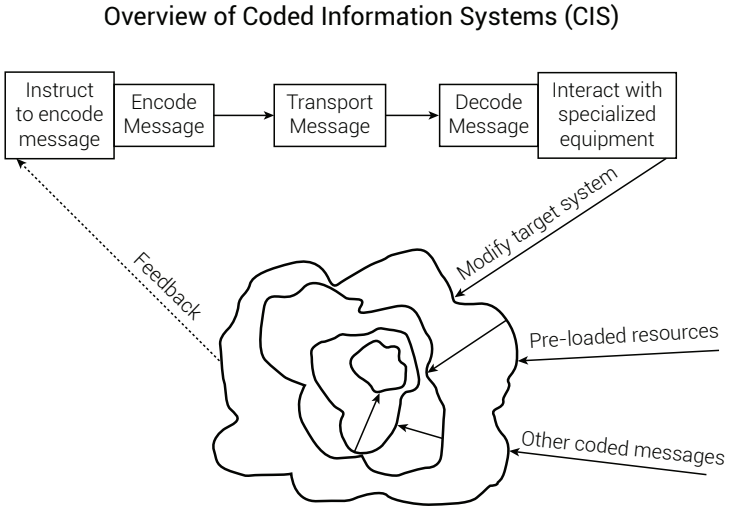

Figure 2. Coded Information Systems sequentially refine behaviour through a series of sequential processes. Each goal-directing refinement step could be influenced through coded messages, sensors, physical hardware, or pre-existing resources. At least one process is guided by coded instructions in order to be classified as a CIS.

in such cases invites discussions on what is meant by 'information', an unprofitable discussion we circumvent by focusing on the concept of Coded Information Systems (CISs). Living organisms reflect the most sophisticated form of CIS: those able to adapt autonomously to new circumstances without requiring new active participation from their designer.

We have good reasons to believe life on earth was conceived to be autonomously adaptable. Genesis 2:2 states that by Day 7 God had finished His creative work and rested, and Genesis 1:31 also states that God saw that all He had made was very good. This would not characterize a biosphere which then fell apart upon cessation of the creative work, in the current and next generations. A biological world acting autonomously in the future—without the need for constant active adjustments—must have built-in features foreseen to adjust to new contingencies. This includes adapting to eventualities during an organism's lifetime and also within new ecological arrangements. Visible benefits may occur within a second, such as rapid reflexive actions (removing a hand from a hot object). A reaction could also take a few seconds to develop (sneezing), up to minutes (vaso-constriction of skin and limb blood vessels when temperature drops), or hours or months (such as resulting from varying hormone levels). These are examples of automated processes involving: 1) receptors, 2) a control centre, and 3) effector machinery.[27]

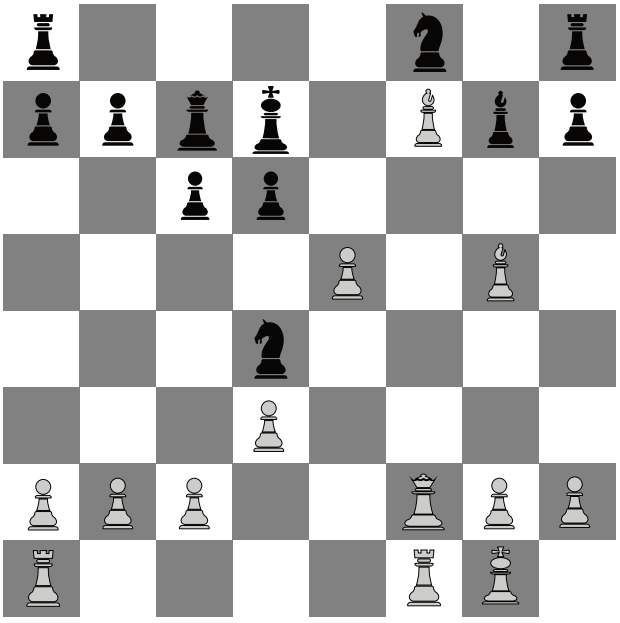

Figure 3. Humans and computer programs can solve problems using broad rules provided in advance. Each unique solution is not hard-coded by the best chess programs for every eventuality (except during the opening moves), and many variants of the above chess problem and countless unrelated other ones can be solved with no need for additional logic-processing resources. (Solution to this problem: 1. Qf5+ Nxf5 2. e6 checkmate).

Open programs are adaptable

Mayr distinguishes between open and closed programs. Instincts and reflexes are examples of 'closed programs'. In 'open programs' such as the capacity to learn languages *information is not rigidly programmed*.[28] Nobel Prize winner Lorenz mentions Mayr's concept of open programs frequently and uses as examples increases in haemoglobin concentration at high altitude and modification of fur thickness with climate changes. He believes these adjustable systems contain more information than closed ones.[29]

A programmed function like X = 2 + 2 has limited value, even though the numbers could be applied to different objects. Used once, one already knows what will result if invoked again. A function like $y = a + b \bullet \log_n(x)$ is more flexible, able to answer a category of questions based on parameter values.

A general-purpose computer subroutine like $sub\_x(p_1 \ldots p_n)$ could also provide additional contextual data not related to the parameters fed in, such as who requested the result, when it was requested, total execution time, and what hardware was used. Such open programs can avail themselves of input from other sources. Multi-purpose programming is more efficient than to create a multitude of individual programs, perhaps with different computer languages and hardware, to deliver all these services.

Biological CISs display anticipatory planning

We introduced above the concept of a sophisticated CIS being adaptable. There is no deterministic instruction book in DNA which pre-specifies every exact eventuality. Oyama wrote in *The Ontogeny of Information*:

> "On the contrary, the more sophisticated the program, the more subtly it responds to its input. A program whose output were completely specified by ('completely controlled by') the program itself would be of limited value."[30]

Living systems are designed to respond to *classes of challenges*. Intelligent beings adjust dynamically with every step they walk, every bite they chew, every time they approach an object. Every eventuality has not been pre-coded on DNA or elsewhere, unlike deterministic computer programs. Processes such as maturation of B-cells; wiring of neurons; the layout of veins; and the location of muscle fibres further emphasize this general truth. The ability to adapt to novel food sources never encountered before, knowable of course to the Creator in advance, is consistent with the Design worldview.

A robust design of CISs requires anticipatory planning adaptability to guide short, middle, and long-term responses to cover within and across generational eventualities. Some changes would only be expressed in the offspring. 'Death', for example of tree leaves, when theologically properly understood is not controversial.[31] Developmental pathways in higher organisms rely often on programmed cell death (apoptosis)[32] for example to eliminate webbing between digits.[33] Surely sperm cells, which would accumulate over multiple mating events, weren't intended to live forever. However, we disagree with Darwin's view that death across all forms of life was necessary to permit overall higher improvement from a single common ancestor.

Adaptations of organisms to new environments can be permanent or temporary, sometimes involving guided genetic modifications fixed in future generations through inheritable epigenetic modifications.[34] Some adjustments require replacing living components within the host organism's lifetime. Long periods of dryness cause spruce trees to sacrifice their 7-year-old needles by cutting off moisture and most nutrition to them, transferring the resources elsewhere in the tree.

Genetically identical organisms can respond to external cues to develop very different morphologies, a phenomenon known as *plasticity*.[35] This could mean variability along a single trait, such as number of red blood cells as a response to altitude (oxygen content), or length of legs on lizards, or multi-trait developmental polymorphism. Examples include colour forms of caterpillars, pupae, and butterflies, winged and non-winged morphs of water striders and plant hoppers, sexual and asexual forms of aphids, and caste systems among social hymenopterans.[36]

These broad and often reversible changes permit many members of the population to respond to environmental changes without requiring mutations. The responses can modify the coordinated expression of many genes. Light absorption by a single photoreceptor in *Arabidopsis* affects up to a third of its genes and defence mechanisms have been shown to change the expression of over 2000 genes. Drought and cold stress are shown to modify the expression of at least 1,300 genes.[37]

Flexible designs, pre-planned to respond to different signals are more sophisticated than multiple dedicated programs, and especially in biology would be more efficient in usage of matter and energy, reproduction, and maintenance. Creation scientists were pleased to learn about overlapping codes,[38] multiple reading frames, translation slippage, alternative splicing, alternative regulation in different tissues, and development stages, plus all the other examples of efficient multi-purpose programming in cells.[39] The latest discoveries reveal that virtually all DNA has informational relevance, involving a larger number of superimposed codes.[40,41] All the evidence confirms that adaptability and regulatory robustness are far more sophisticated than suspected a decade ago.

None of these possibilities were predicted by evolutionary theories. Not only do these discoveries open exciting areas for research by those believing in Design, but also confirm the expectation of brilliant usage of informational principles. The evolutionist is more comfortable with notions like huge amounts of junk DNA and flawed designs which barely work. Without foresight, once a system has been committed to an architectural approach future changes must conform to the built-in constraints.[42]

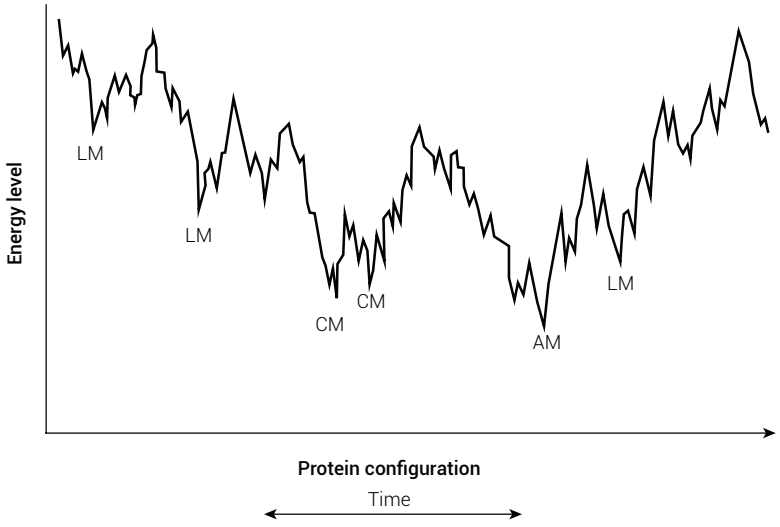

Figure 4. Energy diagram of protein folding showing intermediate, meta-stable states as configurations are explored to find more stable states. The fluid cellular environment, suitable temperature, exclusion of interfering molecules and strong UV light, small changes in energy level for similar configurations (to permit backing out of a false solution), presence of chaperones, availability of salt bridges, sulphide-sulphide bonds and alpha-helices and beta-sheets are some of the resources used by the algorithm to iteratively search for the intended folded state. Being robust to change, mutations in natural proteins will often produce a variant of the folded state optimized for a new environment. LM= Local Minimum; CM = Close to Minimum (as used by conformational switches); AM=Absolute Minimum.

Flawed evolutionary understanding of adaptability

How could examples of adaptability be attributed to Design or evolution? Evolutionary theory has never presupposed, and is incompatible with, the presence of sophisticated anticipatory guidance to protect populations. Unguided evolution, whether neo-Darwinian theory or other evolutionary framework,[43] requires

the underlying mechanisms to be naturalistic *in toto*. Explanatory terms like 'canalized development'[44] must be immediately questioned: what is the source of the guidance being provided?

For decades the evolutionary community claimed that random mutations in the protein coding regions of genes plus natural selection explained the origin of virtually all biological features. We are now seeing a massive paradigm shift whereby such point mutations are essentially and correctly recognized as irrelevant for the big picture.[45] However, the new discoveries responsible for complex development and adaptability are being claimed to be unguided evolutionary processes.

In *Arrival of the Fittest*[10] Dr Wagner shows how bacteria can develop novel metabolic paths by accepting genes coding for the necessary enzymes from other bacteria. We view this as a clear example of designed adaptability, an improvement over placing all relevant genes on the same genome initially if not needed at that time and place. The design optimizes from an ecological perspective. Since the output from one enzymatic reaction serves as the substrate for a second one, and its output as raw material for a third one, and so on, then producing the entire path in a new host can occur automatically once the means to easily exchange, add, and eliminate entire genes has been made possible.[46] In many cases only one or two new genes would need to supplement those already present in the host to permit metabolic processing of a different substance.

Change is not the same thing as evolution unless it unambiguously supports the notion of origin of new organisms from a *single* common ancestor. Creating *one* new strain by requiring genes from *two* or more pre-existing strains does not demonstrate this. Useful change is a fundamental and necessary feature of life. Fertilized eggs become mature individuals; from a generalist bacteria population many specialized strains arise, optimized to various niches; and plants show rich varieties in different environments. None of these examples support the grand scheme claimed for evolution.

If the scientific community could agree that information-controlled biological change occurs, often very rapidly, but that there is—at least at this time—no proof the informational guidance arose from purely naturalistic sources, the creation vs evolution conflict would to a large extent dissipate. Discontinuing the habit of attributing miraculous properties to 'evolution'[47] and claiming science explains everything and disproves God's existence, would permit all scientists to concentrate harmoniously on elucidating the fine details of the informational mechanisms involved. CIS theory was developed to provide a more neutral worldview framework for research.

Conclusions

Enzymatic degradation by bacteria of materials generated from the production of nylon-6 is an example of what they have been designed to do: recycle and break down larger biochemicals. This is not an example of information arising for free in nature, and far less answers the question of their origin as Coded Information Systems, including the complex molecular machines needed to create the kinds of macromolecules being degraded.

There is no difficulty for creation scientists in understanding degradation of synthetic substances by bacteria once CIS thinking has been digested (pun intended). In the case of materials resulting from the manufacture of nylon-6, only amide bonds in a slightly different chemical context had to be hydrolyzed, a rather trivial requirement given the huge variety of pre-existing enzymes performing a similar task. But like the movement of a kite which might appear to be random (until one realizes that a string is being intelligently pulled at the right times), deeper analysis of the biological basis which produces changes reveals sources of informative guiding factors.

CIS theory clarifies how biological designs work by identifying four *refinement components*: coded messages, sensors, physical hardware and pre-loaded resources. The solution architecture involves interaction and interplay of these informational resources. The later adaptations to new environments can be temporary or permanent, sometimes involving guided stable genetic modifications.

Intelligent design of individual organisms and ecologies requires that biological Coded Information Systems be able to adjust to needs spanning sub-second to multi-generational time intervals. Like the best information processing designs, biological designs are open programs, able to cope with challenges whose individual solutions were not hard-coded in the instructions. General logic-processing principles are involved which include exchanging genes with other prokaryotes; eliminating genes no longer needed; iterative fine-tuning with the help of feedback towards a useful goal; the use of huge population sizes; short generation times; robustness of protein structures permitting variation;[48] and mutational rates which are neither too high nor too low to permit fine-tuning of enzymes without wreaking havoc on genomes. These are parts of an intelligent algorithm to solve and overcome novel challenges and problems while ensuring collective survival.

References

1. Truman, R., Nylon-eating bacteria—part 1: discovery and significance, *J. Creation* **29**(1):95–102, 2015.
2. Truman, R., Nylon-eating bacteria—part 2: refuting Ohno's frame-shift theory, *J. Creation* **29**(2): 78–85, 2015.
3. Truman, R., Nylon-eating bacteria—part 3: current theory on how the modified genes arose, *J. Creation* **29**(2):106–109, 2015.

4. A Short History of Manufactured Fibers, www.fibersource.com/f-tutor/history.htm.
5. Dembski, W.A., *No Free Lunch: Why Specified Complexity Cannot Be Purchased without Intelligence*, Rowman & Littlefield, Lanham, MD, 2002.
6. Amidases are classified according to the EC scheme under category 3.5.1.4, enzyme.expasy.org/EC/3.5.1.4.
7. Anderson, K.L. and Purdom, G., A creationist perspective of beneficial mutations in bacteria, *Answers in Depth* **4**, 2009, answersingenesis.org/genetics/mutations/a-creationist-perspective-of-beneficial-mutations-in-bacteria/.
8. Borger, P., Evidence for the design of life—part 1: genetic redundancy, *J. Creation* **22**(2):79–84, 2008; creation.com/genetic-redundancy.
9. Borger, P., Evidence for the design of life: part 2—Baranomes, *J. Creation* **22**(3): 68–76, 2008; creation.com/baranomes-and-the-design-of-life.
10. Wagner, A., *Arrival of the Fittest*, Oneworld, London, 2015.
11. Dantzig, G.B., *Linear Programming and Extensions*, Princeton University Press, NJ, 1963.
12. Mitchell, M., *An Introduction to Genetic Algorithms*, A Bradford Book, The MIT Press, Cambridge, MA, 1999.
13. Burden, R.L. and Faires, J.D., *Numerical Analysis*, Brooks/Cole, 9th edn, 2011.
14. Sharma, T., Tiwari, N. and Kelkar, D., Study of difference between forward and backward reasoning, *Int. J. Emerging Tech. and Adv. Eng.* **2**(10):2250–2459, 2012; www.ijetae.com/files/Volume2Issue10/IJETAE_1012_48.pdf.
15. Dembski, W.A., Ewert, W. and Marks, R.J.II, A General Theory of Information Cost Incurred by Successful Search; in: Sanford, J.C. *et al.* (Eds.), *Biological Information: New Perspectives*, Word Scientific, NJ, 2013.
16. Drake, J.W., Charlesworth, B., Charlesworth, D. and Crow, J.F., Rates of spontaneous mutation, *Genetics* **148**(1):1667–1687, 1998.
17. Behe, M.J., *The Edge of Evolution, The Search for the Limits of Darwinism*, Free Press, New York, 2007.
18. Truman, R., Information Theory—part 3: introduction to Coded Information Systems, *J. Creation*, **26**(3):115–119, 2012; creation.com/cis-3.
19. Truman, R., Information Theory—part 4: fundamental theorems of Coded Information Systems theory, *J. Creation*, **27**(1):71–77, 2013; creation.com/cis-4.
20. Wieland, C., Superbugs not super after all, *Creation* **20**(1):10–13, 1997. Purdom, G., Antibiotic Resistance of Bacteria: An Example of Evolution in Action? answersingenesis.org/natural-selection/antibiotic-resistance/antibiotic-resistance-of-bacteria-evolution-in-action/.
21. Truman, R., Information Theory—part 1: overview of key ideas, *J. Creation* **26**(3): 101–106, 2012, creation.com/cis-1.
22. Truman, R., Information —part 2: weaknesses in current conceptual frameworks, *J. Creation* **26**(3):107–114, 2012; creation.com/cis-2.
23. Human and computer languages use grammatical rules which allow the intended meaning to be interpreted. These rules don't need to be re-sent with each communication since the receiver already possess them and knows how to use them. Our minds permit integration with past and present context to infer many things thus simplifying what the sender needs to communicate.
24. Astin, J.A., Shapiro, S.L, Eisenberg, D.M. and Forys, K.L, Mind-Body medicine: state of the science, implications for practice, *J. Am. Board Fam. Med.* **16**(2):131–147, 2003, doi: 10.3122/jabfm.16.2.131
25. To illustrate, we suggest looking at horizontal gene transfer more carefully. Are random pieces of DNA being exchanged, or are the pieces meaningful, for example, such that entire intact genes are transferred which would be operational in the new host? Researchers could look for quality control features guiding how the DNA received gets incorporated into the host genomes. Perhaps duplicates are avoided.
26. Oyama, S., *The Ontogeny of Information: Developmental Systems and Evolution*, Duke University Press, 2000.
27. Levels of oxygen, glucose, mineral ions, pH, temperature, and so on must be regulated to within narrow ranges if an organism is to survive. Martini, F.H., Nath, J.L. and Bartholomew, E.F., Fundamentals of Anatomy & Physiology, 9th edn, Pearson Education, 2012. Relevant portions are available online. See An Introduction to Anatomy and Physiology, Homeostatis and system integration, ©2003 Pearson Education, Inc., wps.aw.com/wps/media/objects/451/462581/CH01/html/ch1_4.html
28. Mayr, E., *This is Biology: The Science of the Living World*, First Harvard University Press, 8th printing, p. 75, 2001.
29. Lorenz, K., *Behind the Mirror: A Search for a Natural History of Human Knowledge*, Mariner Books, New York, 1978.
30. Oyama, ref. 26, p. 132.
31. Cosner, L., 'No death before the Fall'? The importance of the distinction of nephesh chayyah life, creation.com/no-death-before-the-fall. "We don't argue that plants and insects, etc. didn't die before the Fall, and 'what about skin cells' has always been a ridiculous straw man argument: we believe that certain forms of cell death would have had to be programmed at creation, as they are necessary for all multi-cellular life. Broadly speaking, there was no death of vertebrates."
32. Hopkinson-Woolley, J., Hughes, D., Gordon, S. and Martin, P., Macrophage recruitment during limb development and wound healing in the embryonic and foetal mouse, *J. Cell Science* **107**:1159–1167, 1994.
33. Limb development, en.wikipedia.org/wiki/Limb_development.
34. Carey, N., *The Epigenetics Revolution: How Modern Biology is Rewriting Our Understanding of Genetics, Disease and Inheritance*, Icon Books, London, UK, 2012.
35. Junker, R., Die Plastizität der Lebenwesen: Baustein für Makroevolution? (The plasticity of living organisms: buildingblocks for macroevolution), *W+W Special Paper B* **14**(2), August, 2014, www.wort-und-wissen.de/artikel/sp/b-14-2-plastizitaet.pdf.
36. Greene, E., A diet-induced developmental polymorphism in a caterpillar, *Science* **243**(4891):643–646, 1989.
37. Schlichting, C.D. and Smith, H., Phenotypic plasticity: linking molecular mechanism with evolutionary outcomes, *Evol. Ecol.* **16**:189–211, 2002, www.bgu.ac.il/desert_ecology/Novoplansky/Plasticity course 2005-6/Schlichting and Smith.pdf.
38. Trifonov, E.N, Multiple codes of nucleotide sequences, *Bull. Mathematical Biology* **51**:417–432, 1989.
39. Montañez, G., Marks, R.J. II, Fernandez, J. and Sanford, J.C., Multiple Overlapping Genetic Codes Profoundly Reduce the Probability of Beneficial Mutation; in: *Biological Information: New Perspectives*, Sanford, J.C., *et al.* (Eds.), Word Scientific, 2013.
40. Trifonov. E.N., Thirty Years of Multiple Sequence Codes, *Genomics, Proteomics & Bioinformatics* **9**(1–2):1–6, 2011, www.sciencedirect.com/science/article/pii/S1672022911600016.
41. Trifonov, E.N., Second, third, fourth … genetic codes—One spectacular case of code crowding, vimeo.com/81930637
42. For example, Microsoft's DOS operating system was conceived as a single-user system running on isolated hardware. This architectural design does not lend itself to easy improvement for multiple user servers nor to prevent attacks from hackers over the internet. Other operating systems were designed from the beginning with other goals in mind.
43. Gould, J.S., The Structure of Evolutionary Theory, Harvard University Press, 2002. Goldschmidt's Saltation Theory comes to mind and is discussed in this reference.
44. Oyama, ref. 30. The term appears repeatedly in her work and in those she references.
45. Noble, D., Physiology is rocking the foundations of evolutionary biology, *Exp. Physiol.* **98**(8):1235–1243, 2013.
46. Ochman, H., Lawrence, J.G. and Groisman, E.A., Lateral gene transfer and the nature of bacterial innovation, *Nature* **405**:299–304, 2000.
47. Guliuzza, R.J., Darwin's Sacred Imposter: Natural Selection's Idolatrous Trap, www.icr.org/article/darwins-sacred-imposter-natural-selections/
48. Axe, D.D., The case against a Darwinian origin of protein folds, *BIO-Complexity* **1**:1–12, 2010, doi:10.5048/BIO-C.2010.1; bio-complexity.org/ojs/index.php/main/article/view/BIO-C.2010.1/BIO-C.2010.1

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Phylogeny of the horse—from tapir-like hyracotheres or from equine anchitheres?

Barnabas Pendragon

Model-driven interpretation of fossil evidence has led to specious placement of hyracotheres within the horse family. Instead hyracotheres and other Eocene hyracothere-like animals, generally considered to be primitive members of various perissodactyl groups, are interpreted here to constitute a monophyletic family that is phylogenetically independent of the majority of other perissodactyls. Fossil horses are first represented by the anchithere *Mesohippus* in the Eocene strata. Attempts to link the anchitheres (browsing horses) to the hyracotheres are speculative and insufficiently supported by fossil evidence. Therefore, inclusion of the separate subfamily Hyracotheriinae within the Equidae makes the family polyphyletic. A second question, whether the Anchitheriinae represent a separate monophyletic group independent of the Equinae, remains unresolved. Fossil morphological criteria suggest the entire anchithere-equine group is a monophyletic family. The main difference between the anchithere and the equine fossils lies in the teeth, in the characteristic hypsodontic state of the later. The transition from brachydonty to hypsodonty appears to have occurred within a single equine genus *Merychippus*.

Horses have accompanied man since the earliest human civilizations[1,2] and fossil horses bring fascinating insights into paleontology.[3] Since Thomas Huxley gave them a place of prominence, fossil horses and their phylogeny have been an icon of evolution (figure 1). As investigations of the fossil record have become more data-driven rather than hypothesis-driven, our understanding of the evolution of the horse has mellowed. At the very bottom of traditional horse phylogenies is found that curious animal *Hyracotherium* (figure 2), also known by its famous junior synonym '*Eohippus*', and it is accompanied by various similar organisms. The genus *Hyracotherium* comprises a number of separate species and it existed alongside a number of related genera. In horse phylogenies, gaps exist, some more prominent than others. This paper examines the most prominent gap which separates the Eocene hyracotheres from the horses. It looks at whether horse phylogeny began with *Hyracotherium* or with *Mesohippus*, a Miocene three-toed browsing horse. A second accompanying paper will examine the relationship of hyracotheres with other early Perissodactyla. Given that speciation has occurred among extinct and extant horses, the role of adaptive radiation and the types of morphogenetic change involved are also examined.

Extant horses, asses, and zebras clearly belong to a single basic type.[4] The rapid karyotype rearrangements of *Equus*[5] and the extensive equid fossil record mostly confirm a monophyletic origin of the family but what about *Eohippus* and the other hyracotheres? Other important questions include: Which fossils belong to which basic type? What are limits of the morphogenetic potential displayed by the different basic types? Can alternative dentitions be attributed to genetic and epigenetic potential of a single basic type? Can one-toed and three-toed horses belong to a single basic type? Within a basic type all species are related to one another reproductively. Per definition, fossil species must be excluded from basic types, as far as empirical evidence is concerned. Therefore, two taxa are recognized: the basic type, which is a functional concept based on reproduction, and a family or created kind, which includes all species that share a common genetic ancestry. The latter is a theoretical concept, though still based on reproduction. It represents a family of organisms in the true sense of the meaning. It assumes the history of life is polyphyletic, with multiple trees of life (i.e. sylvan not monoarboreal—a forest of separate family trees rather than a single tree of life). Each tree is a family of related organisms comprising one or more basic types, depending on reproductive isolation of extant member species.

Because hybridization events between extinct species are usually impossible to assess, basic type categorization of fossils employs an alternative approach, one based on morphogenetic space as evidenced by documented hybridizations between member species. If the phenotype of a fossil falls within this space, inclusion within the basic type is considered appropriate. If the phenotype of a fossil falls outside this space, but within a basic type's reasonable morphogenetic potential, inclusion within the basic type is still indicated. If the phenotype of a fossil falls within the morphogenetic potential of a basic type, but displays a limited number of characters used to define organisms outside the basic type, inclusion within the basic type is

indicated and the reliability of the defining characters is questioned. Morphometric criteria are used to empirically delineate a morphogenetic space defined by hybridizations. If such principles cannot be applied, 'unspecified basic type' status must necessarily be retained even though classification into higher taxa, including the family, may still be undertaken using alternative criteria.

Does the evolution of the horse begin with *Hyracotherium*?

In this section the question is addressed; whether *Hyracotherium* and related fossils should be included within the horse family. See table 1 for a listing of the horse genera discussed.

In his time, Sir Richard Owen was the foremost zoologist in England and founded the Natural History Museum in London. He was certainly one of the best people to appreciate what it meant when the fossil remains of an unknown beast were given to him by natural history enthusiast William Richardson, who had been collecting specimens from the coast of Kent in 1839. The piece was the front half of a little skull, and the large eyes and short snout gave the initial impression of it being a hare or rodent. However, a close inspection of the teeth, with their cusps and ridges, indicated that it was an ungulate, one of the hoofed mammals. There were similarities to the rodent-like but 'hoofed' hyrax and shortly afterwards Sir Richard christened the fossil *Hyracotherium*, the "hyrax beast".[6] Had there been any clear similarity to fossil horses, Sir Richard would certainly have been aware of it. He had recently described a Pleistocene horse whose fossil remains had been brought from Argentina on the HMS Beagle by Charles Darwin,[7] and he subsequently went on to name the fossil equine genus *Hippidion*.[8] In 1851, Owen even suggested an orthogenetic horse

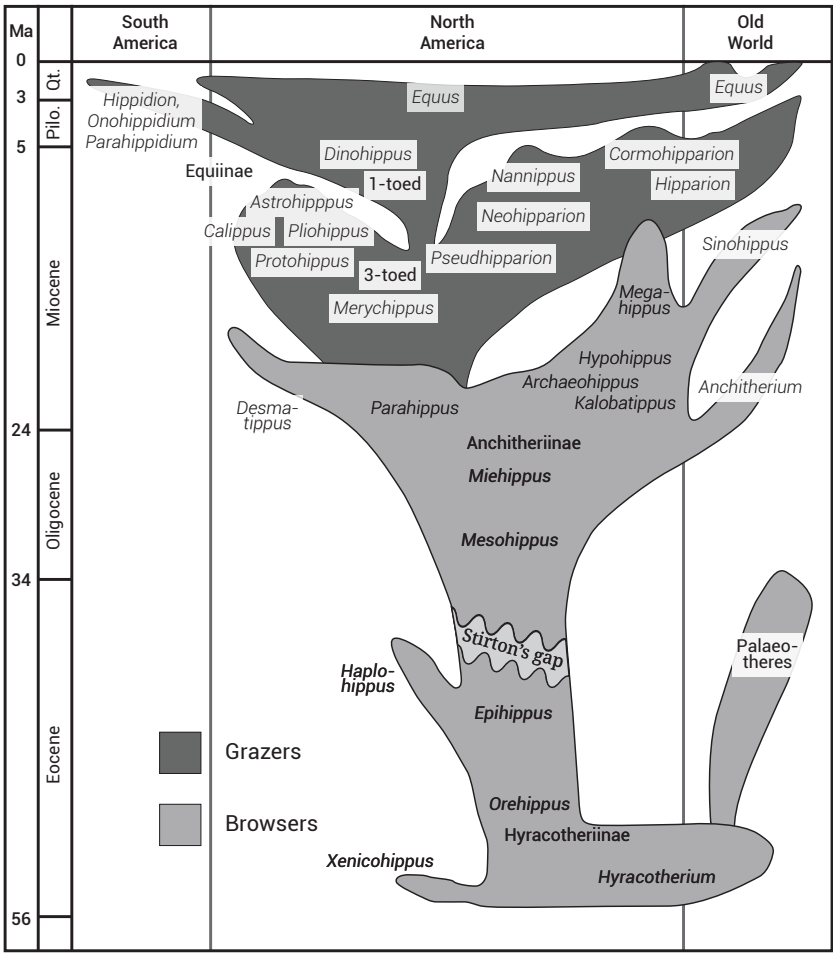

Figure 1. Standard phylogeny of the Equidae; after MacFadden.[3] A gap is indicated between the Hyracotheriinae and the Anchitheriinae. This gap is discussed in detail in the text. Stirton noted in his phylogeny at the site of this gap: "Intergradation between *Epihippus* and *Mesohippus* not proved".[37]

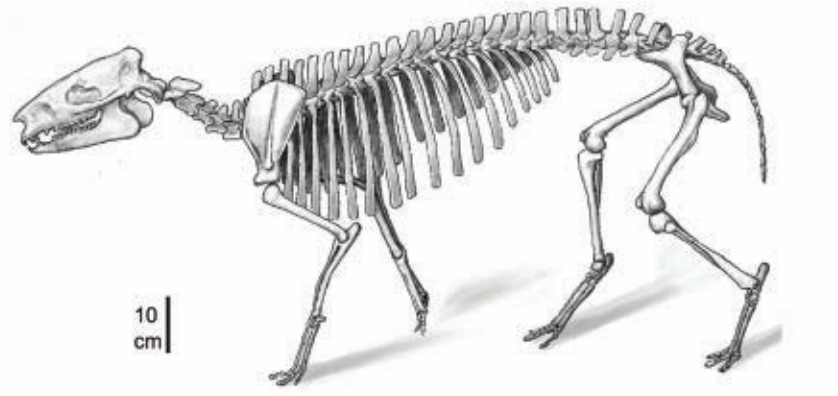

Figure 2. Skeleton of *Hyracotherium vasacciense,* from Lower Eocene strata, North America. This was a large hyracothere, the size and weight of a German shepherd dog. The smallest hyracothere, *H. sandrae*, was the size of a domestic cat and comparable to Sir Richard Owen's 'hyrax beast', *H. leporinum (MacFadden*[3]*).* Drawing by R.W. Sanders.

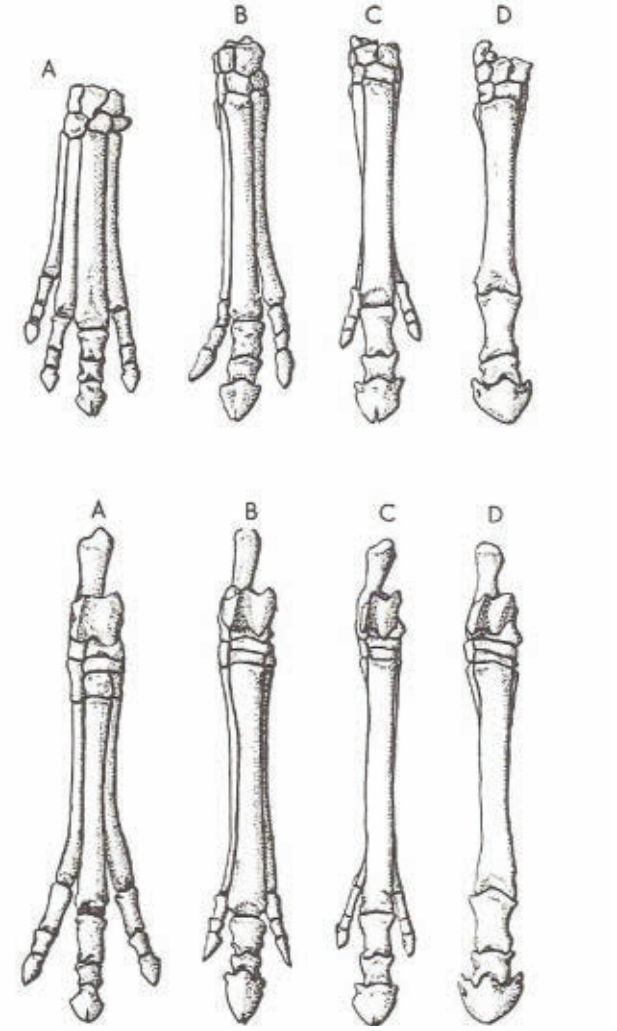

Figure 3. Comparative sequence of feet of Equidae: manus (front foot) above, pes (back foot) below; after Romer.[24] The front feet demonstrate the four-toed splayed foot of *Hyracotherium* compared with the feet of various horses, with their prominent weight-bearing middle toe; see text for details. A) *Hyracotherium*, Lower Eocene; B) *Miohippus*, Oligocene; C) *Merychippus*, Upper Miocene; D) *Equus*, present. Figures not to scale.

sequence starting with *Palaeotherium* (with its three-toed feet) and ending with *Equus,*[9,10] of particular note here because he chose not to include *Hyracotherium*.

Thomas Huxley, a junior contemporary of Owen's, believed deeply in Darwin's ideas and in 1872 he proposed that three fossil ungulates, *Palaeotherium*, *Anchitherium* and *Hipparion*, if placed in order of their stratigraphic appearance, charted an evolutionary path to the modern horse *Equus*. The idea had originated from Owen[7] and was reasonable, except for *Palaeotherium*, which was clearly tapir-like (see next paragraph). The interpretation was hypothesis-driven rather than data-driven. The original phylogeny already contained two remarkable horse fossils. *Anchitherium* was an early Miocene three-toed browsing horse and *Hipparion* was a late Miocene three-toed grazing horse. What was still needed was an animal that was less horse-like, more 'dawn-mammalian', and ideally from the early Eocene. *Palaeotherium*, located in middle and late Eocene strata in Europe, seemed to fit the bill very well.[11]

Palaeotherium was described by Baron Georges Cuvier.[12] It was one of the first fossil mammals to be documented and its remains had been unearthed from gypsum deposits around Montmartre in Paris. It was about the size of a cow and had big heavy bones and broad, three-toed feet with hooves. Its limbs were suitable for walking about in heavy underbrush and wading through swampy ground, rather like a modern tapir. It had a somewhat tapir-like head and a deep notch in the nasal bones, indicating muscle attachments for a tapir-like proboscis.[11] Although not considered a tapir, primarily because of its dental pattern, it was thought to look very similar to one. Instead, it is placed in a separate family, the Palaeotheriidae. Another European Eocene fossil, *Pachynolophus* (synonym *Orohippus*) *agilis*, was subsequently inserted at the front of Owen's original horse phylogeny by Gaudry.[13] This beast was more tapir-like and had a four-toed forelimb (tetradactyl manus) and a three-toed hindlimb (tridactyl pes) like *Hyracotherium* (figures 3 and 4). The name *Orohippus agilis* had already been used by Marsh for an American Eocene fossil with tetradactyl manus and tridactyl pes, that was similar to *Hyracotherium*, and which he had placed at the front of his own horse phylogeny.[14] Yet another Eocene fossil *Protorohippus*, with tetradactyl manus and tridactyl pes and also closely related to *Hyracotherium*, was also placed into a horse phylogeny by Matthew.[15]

Huxley's original phylogeny included not only *Palaeotherium* but two three-toed horses, *Anchitherium* and *Hipparion*. Because modern horses are usually one-toed (monodactyl) this will have come as a surprise to some. However, modern horses with partially developed side toes are by no means unknown. They are referred to as 'horned horses'. It appears to be an inherent part of the morphogenetic potential of the horse. They can form side toes either by excessive embryogenic development of the normally vestigial, lateral toes or duplication of the existing, central toe.[16] The genetic potential of modern horses includes both one-toed and three-toed phenotypes. At least in times past, this apparently enabled the equid basic type to selectively adapt to different ecological habitats. During the middle and late Tertiary, when major horse radiations took place, extra toes would have given better traction on the softer, often marshy, ground (figure 5). The poorly diversified humid forests of the early Tertiary matured into more complex deciduous rainforests, and with the cooling and drying of the climate during the Oligocene and Miocene this biome was replaced by open forest

savanna and grassland savanna.[17,18] As a result, the dominance of early browsing horses gave way to grazing species. In terms of number of species, the three-toed horses were certainly very successful. However, as the great plain ecosystems developed into vast expanses of open, firm land the one-toed horses, generally of greater size and speed, finally began to dominate.[3]

The origin of the iconic series of fossil horses

In 1876, during the centennial celebrations in the United States, Thomas Huxley came to hold a series of lectures and to present his ideas on the evolution of the horse. He visited Yale and spent two days with Othniel

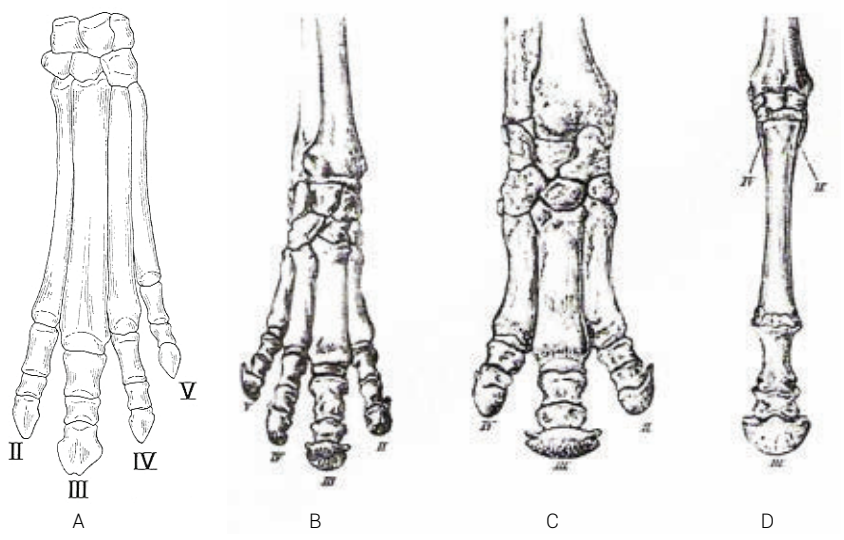

Figure 4. Comparison of forefoot of *Hyracotherium* with those of three extant families of perissodactyls; after Romer;[24] and Flower.[47] A: *Hyracotherium*; B: Tapir (*Tapir indicus*); C: Rhinoceros (*Dicerorhinus sumatrensis*); D: Horse (*Equus callabus*). Roman numerals indicate homology of digits. Figures are not to scale.

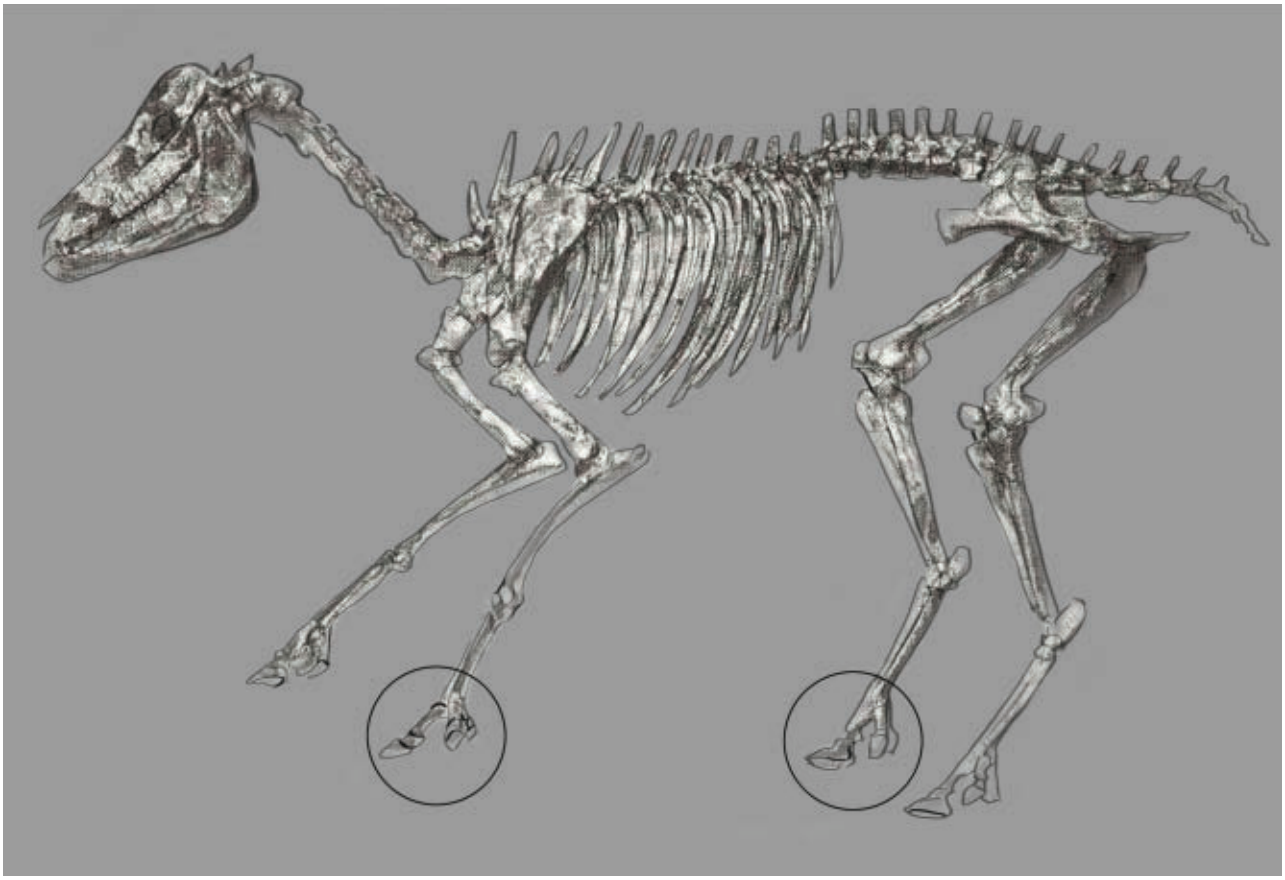

Figure 5. Sketch of the matrix-bound skeleton of *Hipparion*, one of many three-toed Equiinae, from Miocene deposits at Höwenegg, Germany; after MacFadden.[3] The skeleton emphasizes the manner in which the lateral toes are being used for back support for the main weight-bearing central toe. This is in stark contrast to the way the four toes of hyracotheres and extant tapirs form a splayed foot (see figures 3 and 4). The feet are adapted to different kinds of needs in different terrains.

Table 1. Interrelationships among the Equidae (after MacFadden[3]).

Family	Subfamily	Genera cited in text [synonyms]
Equidae	Hyracotheriinae (taxonomic position disputed here)	*Propalaeotherium*
		Eurohippus
		Hallensia
		Hyracotherium [Eohippus, Pliolophus, Orohippus]
		Xenicohippus
		Protorohippus
		Orohippus [Pachynolophus]
		Haplohippus
		Cymbalophus
		Epihippus
	Anchitheriinae	*Mesohippus*
		Miohippus
		Kalobahippus [Anchitherium]
		Anchitherium
		Sinohippus
		Hypohippus
		Megahippus
		Archaeohippus
		Desmatippus
		Parahippus
	Equinae	*Merychippus*
		Parahippus
		Pliohippus
		Calippus
		Nannippus
		Hipparion
		Neohipparion
		Hippidion
		Dinohippus
		Equus

Marsh. Marsh, spurred on by his 'bone war' with Edward Cope, had collected large numbers of North American fossil specimens including many horse species. He had found what he considered to be Eocene horses in the Rocky Mountains. Some three years before, Cope had described what he considered might be 'horse' specimens, recovered from early Eocene beds in Wyoming, naming them *Eohippus*, 'dawn horse'.[11] Nevertheless, the genus name is attributed to Marsh.[19] Cope recognized *Eohippus* was the American equivalent of *Hyracotherium* but still placed it at the base of the American horse phylogeny. When Huxley discussed these matters with Marsh, he was delighted. The American sequence contained two hyracotheres, two browsing horses, and two grazing horses. Huxley considered this American sequence: *Eohippus-Orohippus-Mesohippus-Miohippus-Pliohippus-Equus* to be superior to the European sequence: *Palaeotherium-Anchitherium-Hipparion-Equus*. No doubt a break with the horse sequence of Owen, with whom he had a long-standing personal grievance,[10] was also welcome. Huxley adopted it for his series of lectures and it has become an icon of evolution ever since. These genera are described in more detail below.

Besides *Equus*, the American sequence contains a grazing horse (subfamily Equinae) with both three-toed and one-toed species, *Pliohippus*.[3] The sequence also contains two browsing horses (subfamily Anchitheriinae), *Mesohippus* and *Miohippus*. These sister genera, which had overlapping temporal and geographic ranges, did not intergrade but from their earliest appearance formed distinct horse genera.[20] They are related to the European *Anchitherium*. The sequence also contains the four-toed *Orohippus*, a close relative of *Hyracotherium*, and *Eohippus*, which is so similar to the European *Hyracotherium* that both Cooper[21] and Simpson[22] argued they are congeneric. This means the name 'Eohippus' is an invalid junior synonym of *Hyracotherium*.[23] Owen never considered *Hyracotherium* a horse. It was about the size of a domestic cat. It had a long, flexible back with a long bony tail. It possibly ran a little like a rabbit. Examination of perissodactyl dental patterns (figure 6) clearly and incontrovertibly reveals the similarities in dentition between *Hyracotherium* and a contemporary early Eocene genus *Homogalax*.[20,24,25]

Recent studies by Hooker[26,27] have resulted in a paradigm shift in interpretation of *Hyracotherium* fossils. He considered them to include a whole variety of closely related species, which gave rise to prominent branches of the perissodactyl order. Owen's species gave rise to the palaeotheres. Marsh's species gave rise to the brontotheres. Yet another species, to which Owen[28] had given the genus name *Pliolophus* (considered a synonym of *Hyracotherium*), gave rise to the horses. This novel interpretation aside, there seems little doubt that the Anchitheriinae—*Anchitherium*, *Mesohippus* and *Miohippus*—were browsing horses and part of a major horse radiation during the middle Tertiary.[20] *Hyracotherium* and *Orohippus* appear part of another story and to understand this we must take a closer look at the perissodactyls.

The discussion so far suggests that the horse basic type includes two subfamilies—the browsing horses (Anchitheriinae) and the grazing horses (Equinae). The third subfamily, the hyracotheres (Hyracotheriinae), appears to encompass a different kind of animal and includes *Eohippus* (=*Hyracotherium*).

Does the evolution of the horse begin with the browsing anchitheres?

In this section we discuss the questions: Are the browsing horses the first true horses observed in the fossil record, and does an unbroken line of fossil evidence exist indicating that browsing horses (Anchitheriinae) and grazing horses (Equinae) belong to the same family (created kind)? See table 1 for a listing of horse genera discussed.

Fossils of browsing horses appear in the late Eocene strata of North America (*Mesohippus*) and the Miocene of Europe and Asia. MacFadden[3,18,23] emphasizes that genera within the subfamily Anchitheriinae (browsing horses) are set apart from the hyracotheres by at least seven synapomorphies including those of the skull, jaws, dentition, and metapodials (the bones of feet). The cheek teeth of all the anchitheres are typically horse-like, being fully and characteristically molarized.[20] The preorbital skull length is expanded (the long horse-like muzzle). The upper leg segments are longer, as well as the toes, once again typical of horses, and the anchitheres are functionally tridactyl in both manus and pes.

The Anchitheriinae include the genera *Mesohippus, Miohippus, Kalobatippus, Hypohippus, Megahippus, Archaeohippus, Desmatippus, Parahippus, Anchitherium,* and the Chinese *Sinohippus*.[25] *Anchitherium* was so common in France that it was one of the first fossil mammals ever found. *Mesohippus* and *Archaeohippus* were both dwarf forms. *Hypohippus* and *Megahippus*, however, were large horses comparable in size to many extant species of horse. During the adaptive radiation of the anchitheres, body size potential was thoroughly explored. The Equinae (grazing horses) appeared possibly as a result of an adaptive radiation from *Parahippus*.[3] Extensive radiations of the Equinae took place as grasslands developed. It is reasonable to assume that these creatures through their grazing habits literally carved out their own habitat replacing forested savanna with grassland savanna and steppe. When one considers the enormous size of the buffalo herds on the prairies described by early European settlers, it is not difficult to imagine how equine herds of similar magnitude would have helped sculpt these vast grasslands.[11]

Advanced species of the anchithere *Parahippus* and subsequent equine genera displayed a dental feature that made their teeth more durable. It was cement, a bone-like mineral substance that forms a protective cap around the crown. The presence of extensive cement on their teeth gave these horses large grinding surfaces composed of hard enamel ridges above softer, lower regions of cement and dentin. These ridges acted like tiny shearing edges to

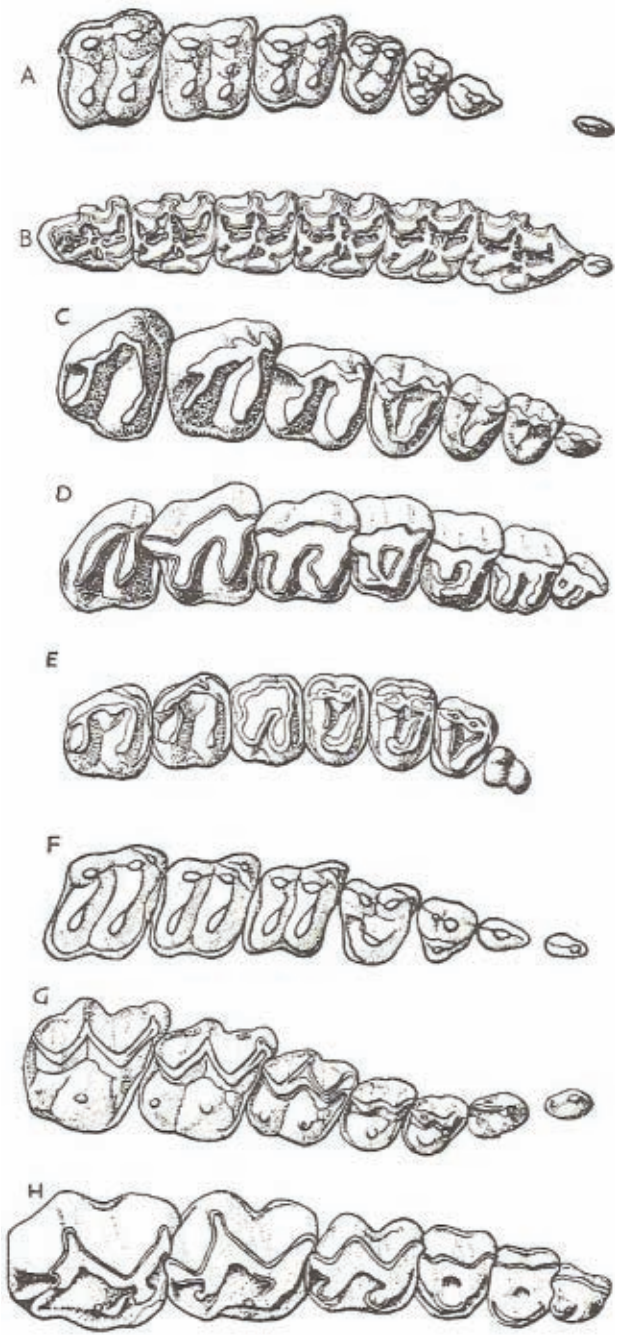

Figure 6. A selection of perissodactyl right upper cheek teeth; after Romer.[24] Contrast the top set of teeth from *Hyracotherium* with those below. Relative sizes compared to *Hyracotherium* are given in parentheses. A) *Hyracotherium* (x 1), B) *Equus laurentius* (x 1/2), C) *Hyrachyus* (x 5/3), D) *Subhyracodon* (x 2/5), E) *Protapirus validus* (x 5/9), F) *Homogalax* (a *moropomorph*, x 1), G) *Palaeosyops* (x 5/12), H) *Moropus* (x 1/3).

efficiently chop plant material into small pieces.[3] *Parahippus* and subsequent equine genera shared other features too. The muzzle is deeper to accommodate the long teeth and the eyes are shifted further back for better vision. The limbs are extended; the lower arms and shins, as well as the toes, are all longer. The genus *Parahippus* represents a heterogeneous assemblage of forms that spans a gradient (morphocline) of dental and postcranial characters. At one end is *Desmatippus*, and at the other *Merychippus*, the first of the Equinae.

The genus *Merychippus* is extremely difficult to diagnose. Its species intergrade almost imperceptibly with those of *Parahippus* on the one hand and those of *Pliohippus, Calippus, Nannippus, Hipparion,* and *Neohipparion* on the other.[29] This continuum from *Desmatippus* and *Parahippus* (both considered anchitheres) to *Merychippus* and other equine genera makes it difficult to separate the browsing horses (Anchitheriinae) from the grazing horses (Equinae).[23] However, the major trend towards high-crowned teeth, hypsodonty, was observed in *Merychippus* (this trend is quite distinct from 'molarization'). So a hiatus between the browsing horses and the grazing horses might exist, being obscured by the precocious appearance of dental cement in *Parahippus* and by 'subhypsodont' specimens of *Merychippus*. If a hiatus does exist, then the Anchitheriinae and Equinae represent separate monophyletic families. However, the presence of intermediate fossil species suggests such a hiatus does not exist. High-crowned teeth and monodactyl limbs did not appear simultaneously in the fossil record. Although all extant equids are monodactyl, only in the more recent equine genera did monodactyl limbs appear. The question remaining is what caused the apparently 'directed' morphogenetic adaptations of dentition and limbs?

Ecological successions and adaptive radiations during the Tertiary[30]

Popular contemporary interpretation of the paleontological finds suggests that during the course of the Tertiary period gradual cooling and drying caused major shifts in the dominant biomes, i.e., ecological succession. The subtropical early Tertiary earth was rapidly recolonized by poorly diversified forests which matured into complex deciduous rainforests.[11,17,18] The fossil evidence indicates that during this period hyracothere-like animals underwent a major adaptive radiation. However, these conditions did not last, and when cooling and drying began during the middle Eocene the subtropical rainforests were replaced by woodland savanna. These more open forest conditions resulted in dominance of the anchitheres, initiating their own adaptive radiation, and the fading away of the hyracotheres. With further cooling and drying of the global climate, at the Oligocene-Miocene boundary, the woodland savanna was replaced by a grassland savanna. The anchitheres in turn were superseded by the Equinae, which underwent at least two adaptive radiations of their own: first, tridactyl Hipparionini genera filled North America; then, towards the end of the Miocene as the grassland savanna was replaced by prairie, these were replaced with the predominantly monodactyl Equini genera[11,18] (see figure 1). Extensive changes in both fauna and flora occurred at this time evidenced by a massive decline in the extremely species-rich browsing communities.[31,32] This may have triggered or fostered the monodactyl equine radiation.[18,33]

The adaptive radiations which took place are extremely instructive as examples of speciation processes. Two types of adaptive radiation were observed. When an adaptive zone, a novel biome such as woodland savanna or steppe, appeared then branching speciation (cladogenesis) took place which was associated with an increase in species number.[33] This was followed by replacement speciation, where the number of species remained approximately constant but 'fitter' descendant species simply replaced ancestral species. Eventually, stasis was reached where essentially no new speciation occurred. In all mammalian radiations, body size has been a character which displayed great variation. In perissodactyl radiations dental characteristics also underwent adaptive radiations. The hyracotheres displayed modest increases in molarization, which may have resulted from access to expanding browsing potential. Cement appeared in the anchitheres. Hypsodonty emerged in the Equinae.[23]

Browsing horses and grazing horses are sometimes treated as two separate kinds, or families, of animals.[34] Although a distinct possibility, it is not necessary to classify them in this complex manner. It is more parsimonious to assume animals differing primarily in quantitative traits belong to a single kind, or family. This problem is encountered in a number of families. An early attempt was made to separate small cats and big cats into two clades. Reasons included differences in ability to roar, in feeding posture, and in pupil shape. It was found that these phenotypic features were never entirely characteristic of either clade. Eventually, based on hybridization criteria, it could be demonstrated that all cats belong to a single basic type.[35] An attempt was made to separate foxes and other canids. Because no fox-like dogs have been observed and a wolf/fox transition would require complex phenotypic change, it is not unreasonable to assign them to separate kinds. Once again, based on hybridization criteria, it was demonstrated that foxes and dogs belong to the same basic type.[36] In both cases, large and small but otherwise 'phenotypically equivalent' animals belong to a single genetic group. Genetic mechanisms are well

able to account for significant intergeneric diversification during standard speciation events, as will be discussed in a future article. Such mechanisms are sufficient to explain the quantitative phenotypic differences between browsing and grazing horses. There is no need to place these animals into separate kinds. This situation cannot be compared to the fundamental phenotypic hiatus between horses and hyracotheres indicative of separate kinds, or families.

Ancillary characters permit adaptive radiation within fixed basic types

Rates of equid speciation peaked during the middle Miocene when between 11 and 13 genera existed.[3,18,33] Changes in dentition continued. Hypsodonty developed in the genus *Merychippus* in the Miocene and continued in the genus *Nannippus* in the Pliocene.[37] Crown heights, occlusal measurements, and dental patterns all varied morphogenetically. Crown heights in the Equinae displayed unidirectional increase in height reflecting adaptation to grazing strategies in the developing grasslands.[18] This is because grasses are tough and abrasive, containing grit-like silica-body secretions, phytoliths, in the epidermis so they rapidly wear down teeth. Under certain circumstances high-crowned horse species can revert to browsing.[38] Limb structure also displayed great flexibility. Limb lengths—upper limbs, lower limbs and digits—all displayed adaptive change promoting cursoriality and speed, which were of great benefit in open grassland environments. Such changes do not require extensive morphogenetic reprogramming. Such 'ancillary' character changes are common in many mammalian radiations: dentition in the felids, tusk morphology in the Proboscidea, horn structure in the Antilocapridae and Dromomerycidae, etc. Such ancillary character variation does not alter the basic type of animals but it generates important adaptive variation and can be readily programmed into a genome.

Another adaptation, the transition from tridactyly to monodactyly, was not unique to horses. Several families of ungulates lost toes, though few did so to the extent observed in the monodactyl equids. A notable imitation, however, is to be found among the horse-like but unrelated litopterns, a group of extinct herbivorous South American ungulates. The monodactyl *Thoatherium* appears to be descended from the tridactyl *Diadiaphorus*, mirroring this morphogenetic change observed in the Equinae.[39] This transition took place during the early Miocene, which was sooner than the equid transition, probably because grasslands became established sooner in South America.[18] Interestingly, *Thoatherium* had low-crowned browsing teeth; it had developed one-toed feet without becoming a grazer. In the legs of another group, the ruminant artiodactyls, which include cattle, deer, and antelopes, the loss of lateral metapodials and fusion of central metapodials (forming the cannon bone) are skeletal adaptations functionally similar to the adaptations in horses, and both types of adaptation enhanced sustained running capabilities.[11] Here too, ancillary adaptation is a phenomenon associated with speciation in various mammalian families. Ancillary adaptations do not alter the type of organism, are easily accounted for morphogenetically, and endow a group with great adaptive variation.

Within the Equidae, other variable characters include cranial elongation (preorbital muzzle length) and incisor morphology patterns. In addition to a simple lengthening of the preorbital region, the skull underwent many other biomechanical changes that are interpreted as adaptations to grazing. Radinsky[40,41] observed that such changes were not gradual. Instead they occur sporadically when novel adaptive zones appear, e.g. during the transition from *Miohippus* to *Merychippus*, primarily within *Parahippus*. Simpson[42] introduced the following terms: brachytely, for static taxa (e.g. coelacanth, ginko); horotely, for 'normally' changing taxa; and tachytely, for rapidly changing taxa, particularly those invading novel adaptive zones. Clearly, *Parahippus* and *Merychippus* were tachytelic genera. Besides climate and vegetation, other factors would also have promoted the adaptive radiations observed in these genera: factors such as changing predator-prey relations, which would affect limb length to increase speed, and coarseness of soil particles ingested when grazing on short or sparse grasses, which would affect dentition.[3,18]

Conclusions

Based on morphological criteria, it seems reasonable to include the Hyracotheriinae and various other contemporary and related genera into a monophyletic group. Besides the hyracotheres, the group includes *Radinskya,* various generalized moropomorph families, various species conventionally believed to be primitive brontotheres and chalicotheres, and probably the palaeotheres (see accompanying article). Together these species form a family or created kind. The members of this clade apparently underwent a major adaptive radiation during the early Eocene when subtropical deciduous rainforests were the dominant global biome. Subsequent fragmentation of the group due to climatic and oceanic conditions (vicariance events) would provide an explanation for differences observed between the closely related North American hyracothere-like perissodactyls and the European palaeotheres.

There is evidence of descent with modification in the adaptive radiations of the Tertiary horses, as a family independent of the Hyracotheriinae. Horses got larger, their

teeth longer, and their toes fewer. Descent with modification is thought to have occurred in other families too. Rather than being a completely stochastic process, it appears that adaptations have been directed by climactic change and resultant biome change, i.e. ecological succession. As novel adaptive zones arise, they bias the direction of the adaptations of the animal species present. These species in turn can influence the development or establishment of the existing biomes. Adaptive radiations of the horse give well-documented and reasonably complete histories of the impact of these changes on ungulate habitats. They provide a pattern with which to compare, and from which to extrapolate, aspects of the adaptive radiations of other more poorly documented fossil groups.

An important observation is the prominent contribution of plastic ancillary characters during adaptive radiations. The morphological changes in the phylogeny of horse species were affected by ancillary adaptations. Such adaptations can be explained as the result of modest morphogenetic reprogramming. A continuum of speciation events led to the establishment of various novel horse genera. However, there is no convincing evidence to suggest that horses were either derived from another type of organism or changed their basic type to become another sort of organism. The proposed transition from early tapir-like hyracothere to Oligocene browsing horse remains specious argumentation at best.

In 1940, Stirton[37] proposed a very realistic phylogeny (although *Dinohippus* rather than *Pliohippus* is now considered the closest outgroup of *Equus*[18]). He indicated a clear hiatus at the *Epihippus*-*Mesohippus* boundary and specifically writes into his phylogeny: "Intergradation between *Epihippus* and *Mesohippus* not proved."[37] This is still true. The hyracotheres had at best only partially molarized premolars. Their limbs were less restricted in their movement, causing a looser gait, which is far removed from the typical springy, yet precise, leg movement of horses. There is evidence that the functional digits of the tetradactyl manus and the tridactyl pes terminated in pads. In contrast to horses, hyracotheres probably lacked bony hooves.[3,43] In terms of overall locomotion, the hyracotheres had a less springy gait and lower maximum speed.[43] The hyracotheres also demonstrated a different stance with less-elevated shoulders when compared to horses. Given that extant tapirs are generalized for these features (but not the specialized skull and proboscis) they serve as a "close functional analogue"[3] for these early generalized perissodactyls. Thus, hyracotheres were small, moropomorph-like animals. Till the present day Stirton's observation holds: "Intergradation between *Epihippus* and *Mesohippus* not proved."[37] Ernst Mayr acknowledged Stirton's gap in his seminal book *Principles of Systematic Zoology*. He commented: "It is true that the fossil record gives substance to phylogenetic trees, but the gaps in the record are still sufficiently large even in the best-known groups to require much conjecture."[44] Franzen affirms this stating: "The continual transition from lower Eocene *Hyracotherium* to middle Eocene *Orohippus* as well as from *Orohippus* to *Mesohippus* has still to be substantiated by fossil evidence."[45]

Franzen, a leading European authority on horse evolution, in his recently translated reference book *The Rise of Horses* writes, "We are still a long way from tracing evolutionary development of the horse from species to species. Considering the gaps in the fossil record, it is questionable whether we will ever achieve this aim."[46] He is the world expert on three European, hyracothere-like genera: *Propalaeotherium*, *Hallensia* and *Eurohippus*; whose remains, even soft body parts, were wonderfully preserved at various sites in Germany, including Grube Messel, and which are considered a side branch of the equid line that went extinct. These 'dawn-horse' genera are all similar, and belong to the stem group *Hyracotherium*, though more primitive (i.e. less horse-like). Small as a fox terrier, possibly loping along like a rabbit, and with an arched back like a duiker or muntjac; in response to the question, how could this small animal, *Hyracotherium*, arrive at its position as the ancestor of all horses, Franzen candidly acknowledges the importance "theoretical considerations"[46] (i.e. interpretive bias) play in such deliberations. In addition, in response to the anterior question, how such animals could have evolved from an ancestral dawn-ungulate Franzen concedes, "The first chapter in the evolution of the horse—during which all of these developments took place—is missing."[46]

References

1. Outram, A.K. *et al.*, The earliest horse harnessing and milking, *Science* **323**:1332–1335, 2009.
2. Ludwig, A. *et al.*, Coat color variation at the beginning of horse domestication, *Science* **323**:485, 2009.
3. MacFadden, B.J., *Fossil Horses: Systematics, Paleobiology, and Evolution of the Family Equidae*, Cambridge University Press, Cambridge, 1992.
4. Stein-Cadenbach, H., Hybriden, Chromosomenstrukturen und Artbildung bei Pferden (Equidae); in: Scherer, S. (Ed.), *Typen des Lebens*, Pascal-Verlag, Berlin, pp. 225–244, 1993.
5. Trifonov, V.A. *et al.*, Multidirectional cross-species painting illuminates the history of karyotypic evolution in Perissodactyla, *Chromosome Res.* **16**:89–107, 2008.
6. Owen, R., Description of the fossil remains of a mammal (Hyracotherium leporinum) and of a bird (Lithornis vulturnis) from the London Clay, *Trans. Geol. Soc. Lond.* **2**(6):203–208, 1841.
7. Owen, R. The zoology of the voyage of the H.M.S. Beagle. Part 1, *Mammalia*, Smith Elder & Co., London, 1840.
8. Owen, R., On fossil teeth of equines from Central and South America, *Proc. Royal Soc. Lond.* **17**:267–268, 1869.
9. Owen, R., Lyell—on life and its successive development, *Quart. Rev.* **89**:412–451, 1851.
10. Desmond, A., *Archetypes and Ancestors: Palaeontology in Victorian London 1850–1875*, University of Chicago Press, Chicago, 1982.
11. Prothero, D.R. and Schoch, R.M., *Horses, Tusks, and Flippers*, John Hopkins University Press, Baltimore, MD, 2002.

12. Cuvier, G., Sur les especes d'animaux dont proviennent les os fossils repandus dans la pierre a platre des environs de Paris, *Annales du Museum National d'Histoire Naturelle* **3**:275–472, 1804.
13. Gaudry, A., *Essai de paleontologie philosophique*, Masson, Paris (1980 facsimilie reprint by Arno Press, New York), 1896.
14. Marsh, O.C., Polydactyl horses, recent and extinct, *Am. J. Sci.* **17**:499–505, 1879.
15. Matthew, W.D., The evolution of the horse; a record and its interpretation, *Quart. Rev. Biol.* **1**:139–185, 1926.
16. Gould, S.J., *Hen's teeth and horse's toes*, Norton, New York, 1983.
17. Wing, S. L., Tertiary vegetation of North America as a context for mammalian evolution; in: Janis, C.M., Scott, K.M. and Jacobs, L.L. (Eds.), *Evolution of Tertiary Mammals of North America*, Cambridge University Press, Cambridge, pp. 37–65, 1998.
18. MacFadden, B.J., Cenozoic mammalian herbivores from the Americas: Reconstructing ancient diets and terrestrial communities, *Annu. Rev. Ecol. Syst.* **31**:33–59, 2000.
19. Marsh, O.C., Notice of new Tertiary mammals V, *Am. J. Sci. Ser. 3* **9**:239–250, 1876.
20. Prothero, D.R. and Shubin, N., The evolution of Oligocene horses; in: Prothero, D.R. and Shoch, R.M., (Eds.), *The Evolution of the Perissodactyls,* Oxford University Press, New York, pp. 142–175, 1989.
21. Cooper, C.F., The genus Hyracotherium: A revision and description of new specimens found in England, *Phil. Trans. Royal Soc. Lond.* **221**:431–448, 1932.
22. Simpson, G.G., Notes on British hyracotheres, *Zool. J. Linnean Soc. Lond.* **42**:195–206, 1952.
23. MacFadden, B.J., Equidae; in: Janis, C.M., Scott, K.M. and Jacobs, L.L. (Eds.), *Evolution of Tertiary Mammals of North America*, Cambridge University Press, Cambridge, pp. 537–559, 1998.
24. Romer, A.S., *Vertebrate Paleontology*, University of Chicago Press, Chicago, figure 384, 1966.
25. Janis, C.M., Scott, K.M. and Jacobs, L.L., *Evolution of Tertiary Mammals of North America*. Cambridge University Press, Cambridge, 1998.
26. Hooker, J.J., Character polarities in early perissodactyls and their significance for *Hyracotherium* and infraordinal relationships; in: Prothero, D.R. and Schoch, R.M. (Eds.), *The Evolution of the Perissodactyls,* Oxford University Press, New York, pp. 79–101, 1989.
27. Hooker, J.J., The beginning of the equoid radiation, *Zool. J. Linnean Soc.* **112**:29–63, 1994.
28. Owen, R., Description of a small lophiodont mammal (*Pliolophus vulpiceps*, Owen), from the London Clay, near Harwich, *Quart. J. Geol. Soc. Lond.* **14**:54–71, 1858.
29. Stirton, R.A., Observations on evolutionary rates in hypsodonty, *Evolution* **1**:32–41, 1947.
30. Uniformitarian stratigraphic names are used for communication purposes only and are not meant to imply acceptance of the millions-of-years chronology. I believe that the K/T boundary most likely represents the Flood/post-Flood boundary worldwide and the post-K/T boundary strata represent the post-Flood catastrophes that provide a record of the successive recolonization of the world post-Flood. See e.g. Whitmore J.H. and Garner, P., Using suites of criteria to recognize pre-Flood, Flood, and post-Flood strata in the rock record with application to Wyoming (USA); in: Snelling, A.A. (Ed.), *Proceedings of the Sixth International Conference on Creationism*, Creation Science Fellowship and Institute for Creation Research, Pittsburgh, PA, and Dallas, TX, pp. 425–448, 2008; and Whitmore, J.H. and Wise, K.P., Rapid and early post-Flood mammalian diversification evidences in the Green River Formation; in: Snelling, A.A. (Ed.), *Proceedings of the Sixth International Conference on Creationism*, Creation Science Fellowship and Institute for Creation Research, Pittsburgh, PA, and Dallas, TX, pp. 449–557, 2008.
31. Cerling, T.E., *et al.*, Global vegetation change through the Miocene/Pliocene boundary, *Nature* **389**:153–158, 1997.
32. Janis, C.M., Damuth, J. and Theodor, J.M., Miocene ungulates and terrestrial primary productivity: where have all the browsers gone? *Proc. Nat. Acad. Sci. USA* **97**:7899–7904, 2000.
33. MacFadden, B.J., Fossil horses—evidence for evolution, *Science* **307**:1728–1730, 2005.
34. Molen, M., The evolution of the horse, *J. Creation* **23**(2):59–63, 2009.
35. Pendragon, B. and Winkler, N., The family of cats—delineation of the feline basic type, *J. Creation* **25**(2):118–124, 2011.
36. Pendragon, B., A review of selected features of the family Canidae with reference to its fundamental taxonomic status, *J. Creation* **25**(3):79–88, 2011.
37. Stirton, R.A., Phylogeny of North American Equidae, *Univ. California Pub. Bull. Dept. Geol. Soc.* **25**:165–198, 1940.
38. MacFadden, B.J., Solounias, N. and Cerling, T.E., Ancient diets, ecology, and extinction of 5-million-year-old horses from Florida, *Science* **283**:824–827, 1999.
39. Colbert, E.H., *Evolution of the Vertebrates*, 3rd edn, John Wiley, New York, 1991.
40. Radinsky, L.R., Allometry and reorganization in horse skull proportions, *Science* **221**:1189–1191, 1983.
41. Radinsky, L.R., Ontogeny and phylogeny in horse skull evolution, *Evolution* **38**:1–15, 1984.
42. Simpson, G.G., *Tempo and Mode in Evolution*, Columbia University Press, New York, 1944.
43. Camp, C.L. and Smith, N., Phylogeny and functions of the digital ligaments of the horse, *Uni. California Mem.* **13**:69–124, 1942.
44. Mayr, E., *Principles of Systematic Zoology*, McGraw-Hill Book Company, New York, 1969.
45. Franzen, J.L., Origin and systematic position of the palaeotheridae; in: Prothero, D.R. and Schoch, R.M., (Eds.), *The Evolution of the Perissodactyls*, New York, Oxford University Press, pp. 102–108, 1989.
46. Franzen, J.L., *The Rise of Horses: 55 million years of Evolution*, Johns Hopkins University Press, Baltimore, MD, 2010.
47. Flower, W.H., *An Introduction to the Osteology of the Mammalia*, 3rd edn, Macmillan and Co., London, p. 295, 1885.

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Warm icy moons

Wayne Spencer

In recent years planetary scientists have been very interested in understanding icy moons of the outer solar system. Europa (at Jupiter), Enceladus (at Saturn), and Ariel (at Uranus) provide interesting case studies of the physical processes affecting moons. It is often suggested by scientists that there could be subsurface 'oceans' in icy moons such as these, but it has proven challenging to explain how such 'oceans' could be prevented from freezing for billions of years. A young-age creation perspective in which heat is still dissipating from creation avoids many of the technical difficulties in explaining these moons.

Solar system missions to the outer planets have provided much interesting data on moons, including some that have active erupting water geysers. Europa (at Jupiter), Enceladus (at Saturn), and Ariel (at Uranus) provide interesting examples for understanding the geology of moons and how it relates to old-age assumptions. All three of these moons are in synchronous rotation (tidal lock) with their host planet, as our moon is with earth. Europa and Enceladus have both been observed with active eruptions of water mixtures significant heights above their surfaces. Eruptions such as these have motivated planetary scientists to attempt to explain the energetics of processes at work in these moons. Old age assumptions are certainly made in this research from secular scientists. However, explaining the heat from these moons and their geological activity has proved challenging to planetary scientists. Assuming a young age, rather than an old age, seems to simplify the issues.

Heat sources in moons of the outer planets include radioactive decay, tidal dissipation, and possibly certain exothermic chemical reactions. Tidal dissipation comes from the moon behaving somewhat like an elastic or plastic body as the gravitational force from its host planet varies. The eccentricity (or degree of elongation) of the orbit is an important factor in tidal dissipation, as well as the composition and internal properties of the moon. In addition, some of the moons in the outer solar system are affected by orbit resonances with other moons. Orbit resonances can cause changes in the shape of a moon's orbit, sometimes very predictably and sometimes rather chaotically. Tidal Dissipation Heating (TDH) stems from the moon's shape being altered from the gravitational pull of its host planet. The tidal effects cause kinetic energy from the orbit and spin of the two bodies to be converted to internal energy within the moon. TDH heating is very significant for Jupiter's moon, Io, for example, as it has very active volcanism. Though TDH is a very strong source of heat for Io, the tidal effects have never been shown to explain all the heat observed in infrared measurements of Io.[1] Io may be the hottest moon in the solar system, but it is not alone in creating a puzzling heat issue for scientists.

Spacecraft missions to the outer solar system have included *Voyager 1* and *2*, *Galileo* (to Jupiter), and *Cassini* (to Saturn). Other significant studies have been done from earth or using various astronomy satellites. Ultraviolet and infrared spectra have been studied significantly for some moons. Europa (at Jupiter), Enceladus (at Saturn), and Ariel (at Uranus) have all presented heat problems that expose difficulties with old-age assumptions. Europa and Enceladus have both been observed with erupting geysers and thus they are thought of as being very similar.[2,3] Both Europa and Enceladus have been conjectured to have layers or pockets of liquid water under the surface. Sometimes Europa is described as having a 'global' subsurface ocean, though not all scientists see it as that extensive. Some have suggested that a subsurface ocean could be an environment where some microorganisms could survive.

The challenging question scientists have puzzled over is: how can a subsurface water ocean still exist after billions of years? Over billions of years small bodies should lose their heat and freeze solid in the outer solar system. Yet, Europa and Enceladus have been observed erupting plumes of water. Note that the presence of a subsurface ocean in Europa and Enceladus is not the only possibility. Smaller pockets of liquid might also fit observations. But water geysers and water in the interior require a heat source that can keep liquid water present inside the moon, so this would have been essential throughout the supposed billions of years of its existence. Europa, Enceladus, and Ariel all have water ice as a significant fraction of their mass. The temperature regime of the outer solar system is such that water becomes the 'volcanic medium' for many moons, essentially, rather than molten rock. But the core or mantle of these moons could be rock. Europa is large enough that it could have an iron core, but this may not be the case for smaller moons. Gravity data obtained from orbiting spacecraft does not uniquely determine the interior structure. But it allows multiple possible models of the interior to be constructed.

Table 1. Orbital parameters of icy moons of the outer solar system compared to earth's moon

Moon Name	Planet	Semimajor Axis Distance Ratio	Orbital Period (days)	Orbit Eccentricity	Orbit Inclination
Moon	Earth	60.3	27.3	0.055	5.15°
Europa	Jupiter	9.40	3.55	< 0.01	0.47°
Mimas	Saturn	3.075	0.94	0.020	1.53°
Enceladus	Saturn	3.95	1.37	0.0045	0.02°
Dione	Saturn	6.256	2.74	0.0022	0.02°
Ariel	Uranus	7.30	2.52	0.0034	0.31°

Table 2. Bulk size and density of selected outer solar system moons compared to earth's moon

Moon Name	Planet	Radius (km)	Density (g/cm^{-3})
Moon	Earth	1,738	3.34
Europa	Jupiter	1,569	2.97
Enceladus	Saturn	251	1.2–1.6
Ariel	Uranus	580	1.6

For many of the icy moons in the outer solar system, the crust is likely to be primarily water ice with some darker material mixed in it or covering it. Other ices may be present as well, such as (especially) methane, carbon dioxide, carbon monoxide, and some ammonia ice. The bulk density and sizes of these moons are generally well known thanks to the *Voyager*, *Galileo*, and *Cassini* missions. However, the data on Ariel is limited to mostly the *Voyager 2* mission. Table 1, below, shows orbital data for earth's moon, contrasted with that of Europa, Enceladus, and Ariel, while table 2 shows contrasting physical properties (table 2).[4] Mimas and Dione are also listed in table 1 because they interact with Enceladus. In table 1, the semimajor axis of the moon orbits are expressed as a ratio of the host planet's radius. Thus, earth's moon has a semimajor axis distance from earth that is the equivalent of about 60 earth radii.

Europa

Jupiter's moon, Europa, has a surface of ice displaying a variety of fractures (figure 1). Scientists have long suspected there could be water eruptions on Europa but there was difficulty obtaining a clear unambiguous observation of it until November and December of 2012, when the Hubble Space Telescope was used to make ultraviolet observations.[5,6] Hubble detected significant amounts of Hydrogen and Oxygen coming from the South Pole region of Europa. This is very likely from dissociated water. Observations were made at the periapse and apoapse (closest and farthest distances from Jupiter) of Europa's orbit with the expectation that the eruptions would happen in a predictable manner each orbit. However, the eruption plumes proved to be not as predictable as first thought. Io, Europa, and Ganymede are all in a three-way 1:2:4 resonance in their orbits.[1] This keeps their orbits extremely stable. Europa's orbit has a low eccentricity and the resonance does not cause much variation in the eccentricity of its orbit. A paper was published recently arguing that Europa must be precessing; this means the tilt of its spin axis would be changing periodically.[7] The paper suggests the precession of Europa's spin occasionally enhances the tidal effect.[7] This study tried to relate the location and alignment of fault structures on Europa to the timing of tidal forces and orbit variations. This is a field of investigation now referred to as 'tidal tectonics'. Tidal forces cause fault structures on the surface to alternate between being in tension and compression. This creates many criss-crossing patterns and lineaments on the surface (figure 2). In 'tidal tectonics' the goal is to determine how tidal stresses affect the surfaces and determine how they might be related to geological structures. There is some success with these methods in studying moons. The tidal stresses would make the amount of heat from tidal dissipation vary as Europa's tilt varies over the course of multiple orbits. The spin precession has been suggested as explaining why the eruptions have not been seen every time scientists have made observations.

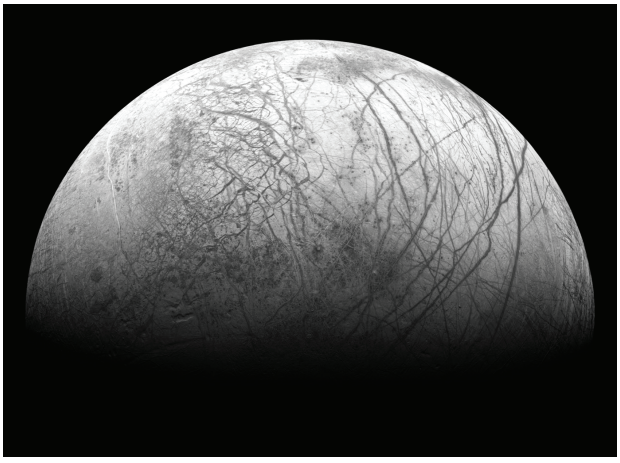

Figure 1. Europa remastered mosaic from the *Galileo* spacecraft, taken in 1995 and 1998. North on Europa is on the right. Image resolution is 1.6 km per pixel. Image has been converted to grayscale.

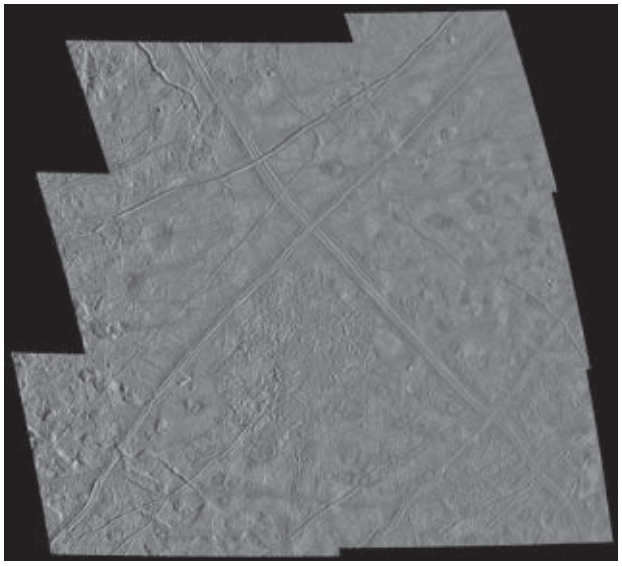

Figure 2. Close-up of Europa surface. From the *Galileo* mission to Jupiter. Image area is 300 x 300 km with north at the top.

The difficulty with this scenario is that theoretical models of the tilt precession require a greater tilt change than gravitational models of the real Europa suggest.[7] Thus tidal dissipation may not be adequate to keep a subsurface ocean liquid for over 4 Ga. One NASA webpage shows Europa's orbit inclination to be tilted 0.466° compared to the spin axis of Jupiter.[8] It is important to determine which effect is more significant in altering tidal stresses, the orbit shape or the spin tilt. The paper by Rhoden, *et al*.[7] is now suggesting Europa had a greater spin tilt in the past. This is because tidal dissipation alone is not an adequate source of heat to keep a subsurface ocean melted. The recent paper by Rhoden[7] has the following statement in the conclusion. Note that a 60° tilt, as mentioned below, would be very surprising for a moon near Jupiter. More on the spin tilt follows below.

> "We find it very unlikely that tidal stress only from eccentricity or with a constant spin pole direction would produce the observed difference in plume activity when Europa was at similar orbital positions. However, if the spin pole precessed by at least 60° between the Dec 2012 and Jan 2014 observations, we do find a more plausible set of candidate faults that are consistent with the observations."[7]

This statement should be compared with the observational evidence on the spin axis tilt of Europa. This requires a determination of the obliquity of Europa. This is the angle between a vector normal (perpendicular) to the plane of the orbit and the spin axis. This was determined by Bills in 2005 from *Galileo* spacecraft gravity measurement data.[9] Bills analyzed the spin precession and orbit inclination changes in relation to Jupiter's shape and tilt and treated the four Galilean moons of Jupiter as triaxial ellipsoids. The study also considered the possibility of periodic changes in the orbital tilt being in a resonant relationship with the spin axis depending on their relative rates. The spin precession rate for Europa was determined to be 0.191 degree/day with an uncertainty estimated as 5%.[9] The results show clearly that Europa's obliquity is much less than one degree and there is no significant orbit-spin resonance effect. The obliquity for Europa was determined to be $(9.65 \pm 0.69) \times 10^{-2}$ degrees and this angle varies very little over time. Thus the observational evidence from the *Galileo* mission appears to rule out a large (60°) change in Europa's spin axis. The tidal forces from Jupiter do cause some precession of the orbit and spin of Europa but it is clearly a very small effect. Thus, for Europa there is still a difficulty with explaining the necessary energy for the eruptions.

Other heat sources in Europa have been considered as well. Some radioactive decay of potassium (or other isotopes) is likely in Europa and other moons, because of the presence of various silicate minerals in the interiors. But radioactive decay for these moons does not generate a great deal of heat because of the limited number of radioactive isotopes present. If there was a subsurface ocean that froze, the ice crust would be essentially coupled to the rocky mantle in such a manner that tidal dissipation would dramatically decrease and eruptions of water would likely stop. I consider the evidence for a subsurface ocean at Europa to be good because of the *Galileo* magnetic data.

Another heat source that might be considered for some moons could be ohmic dissipation due to electrical currents induced by plasma effects or magnetic phenomena within the host planet's magnetic field. Jupiter possesses an extremely strong magnetic field. Jupiter's moon, Io, experiences electrical discharges that create strong currents between Io and Jupiter and this generates some heat in Io. Jupiter's magnetic field is also capable of causing an induced current within a moon if the moon is sufficiently conductive. One of the tasks for the *Galileo* mission was to determine if Europa possessed its own permanent dipole magnetic field or if there was an induced magnetic field at Europa. This was determined to be an induced field in the *Galileo* mission to Jupiter. An induced field will vary in its orientation with Jupiter's rotation period (11.2 hours as seen from Europa[10]), whereas a permanent dipole at Europa would have a more constant orientation. The *Galileo* spacecraft was used to distinguish between the cases of whether the induced field is a) from a Europa iron core, b) from a possible liquid conductor near the surface, or c) from an ionosphere above the surface of Europa. The data from the *Galileo* magnetometer measurements made in January of 2000 point clearly to b.[10] The magnitude of the magnetic variations measured near Europa by *Galileo* covered a range of approximately 18 to 108 nT.[10] Such a weak field cannot

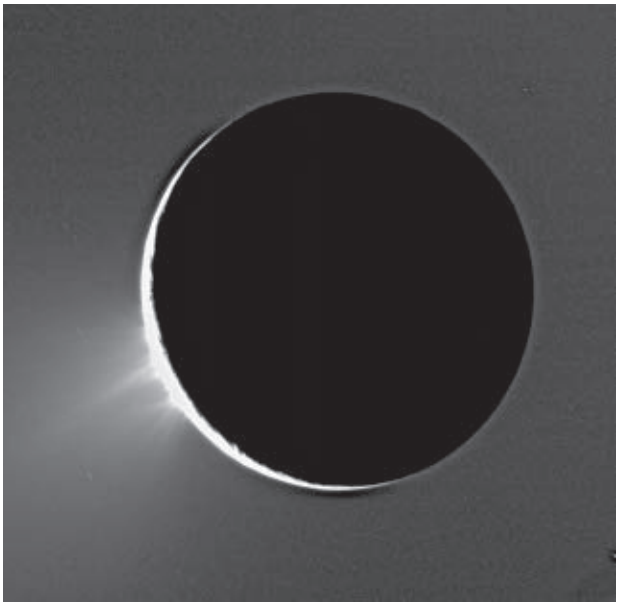

Figure 3. Fountains of Enceladus. Image is from the *Cassini–Huygens* mission to Saturn, taken November 2005.

generate strong heating, but it was unambiguously detectible by the spacecraft.

Thus, scientists want to explain how there can be liquid water or liquid mixtures present in these moons. There is also a hope of some scientists that these subsurface bodies of water could harbor bacterial life similar to life-forms near earth's hydrothermal vents on its ocean floor. At Europa there is likely liquid water erupting as well as oxygen. Spectra suggest that both water and molecular oxygen are being dissociated.[6] The surface also bears few craters and appears to be young. Most planetary scientists regard Europa as being explained by tidal dissipation heating but this does not seem to be the case. Theoretical models have sometimes been proposed that are unrealistic and do not fit observations. A simpler way to explain Europa is to view it as created with internal heat only several thousand years ago. This heat is still dissipating. Tidal dissipation is occurring and there is good evidence of liquid water under the surface, but this liquid would likely freeze if Europa were over 4 Ga old.

Enceladus

Enceladus is an interesting moon of Saturn that poses a more challenging and complex heat problem for an old-age viewpoint. Note first of all that Enceladus is much smaller than Europa, with a radius of only 251 km. This implies it cools more rapidly due to its smaller size, yet it possesses geysers that erupt with some regularity (figure 3). It is also relatively close to Saturn, which allows for a greater tidal effect. Enceladus is positioned within Saturn's E Ring. On the other hand, Saturn's tidal effects are much less than Jupiter because Saturn is considerably less dense and much less massive. Overall, the tidal effects are stronger at Enceladus than Europa. A recent paper[11] explained the issue with this opening statement:

> "Despite its small size, Enceladus emits considerable heat at its south pole, even long after simple thermal models predict that Enceladus should be frozen. The latest estimates of energy release range from 4.7 GW to 15.8 GW, depending on wavelength."[11]

Enceladus has been observed to have more regular eruptions from near its South Pole than Europa.[10] The eruption plumes consist of solid particles and vapours. The solid particles include both very small silica particles, similar to those in the E Ring, and salt particles. Gases at least sometimes present in the eruption plumes include carbon dioxide, methane, and ammonia.[11,13] Today scientists generally believe there is a kind of partial ocean or regional ocean under Enceladus's South Pole. There are also significant ridges

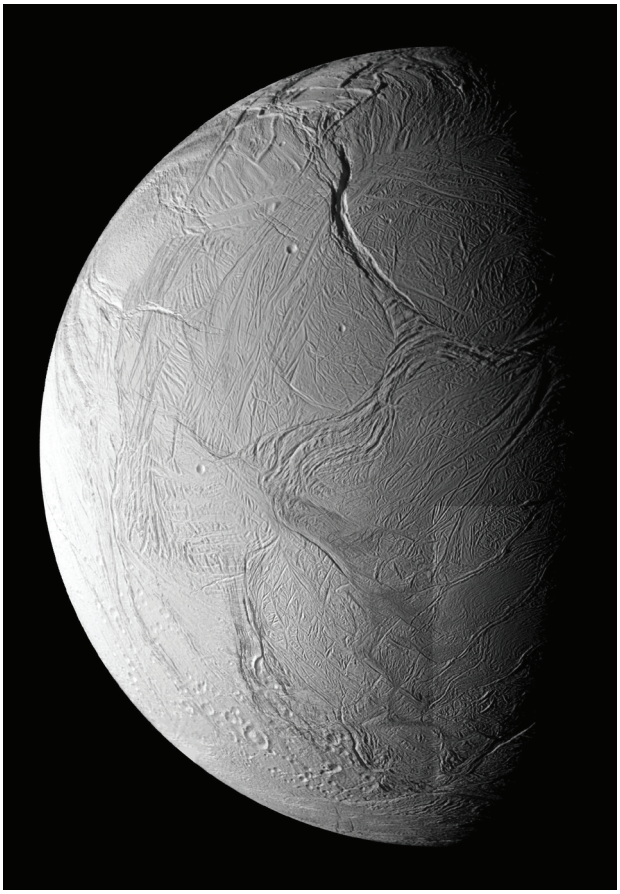

Figure 4. Enceladus with 'tiger stripes'. Photograph from the *Cassini–Huygens* mission, taken October 2008. Image has been converted to grayscale. Tiger stripes region (near the South Pole) has been brightness enhanced 40% and contrast enhanced 10% for clarity.

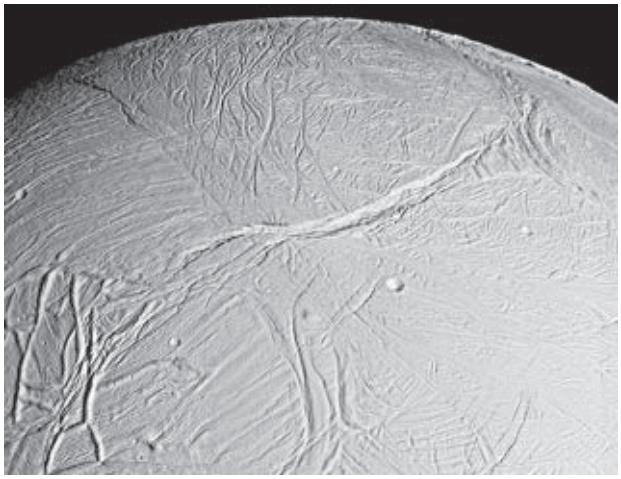

Figure 5. Enceladus's surface canyons. Mosaic visible light image from the *Cassini–Huygens* mission, taken February 2005. The view is approximately 300 km in width.

and fault structures on Enceladus's surface that have been called 'tiger stripes' (figure 4). These 'tiger stripes' are the location of eruptions of liquid.[10] Enceladus's surface is one of the brightest among all the moons of the solar system. It also possesses large linear canyons (figure 5). Enceladus's eruptions are more regular and longer-lived than those of Europa. Thus the challenge is: how can there be large amounts of liquid water in an icy moon allegedly billions of years old?

Heat sources considered for Enceladus include radiogenic heat, exothermic chemical reactions from serpentinization, constant TDH, episodic TDH cycles, and coupled constant plus episodic TDH. (Enceladus did cause some minor variations in Saturn's magnetic field but these were not significant for generating heat from induced currents.) Radiogenic heat is estimated to be only approximately 0.3 GW, presently.[11] Serpentinization has been proposed as a possible process for the formation of Enceladus's core. Serpentinization happens in earth's oceanic crust. It includes chemical reactions involving absorbing water in which magnesium silicates can change form. Serpentinization can also be accompanied by an increase in volume. It is believed that shortly after Enceladus's formation serpentinization could have generated significant heat, but it would not have been long-lived. Note that small quantities of ammonia have been observed in the Enceladus eruption plumes. But in order to make the serpentine reactions a strong heat source, some have suggested that the ice on Enceladus could be composed of as much as 30% ammonia ice mixed with water ice. However, one estimate suggests serpentinzation of Enceladus's *entire* core would generate heat that would completely dissipate in only about 40 Ma.[11] The best heat source proposed seems to be the coupling of constant tidal heating and periodic episodic tidal heating. This can generate an upper limit of about 1.5 GW,[14] but this is much less than the observed heat levels quoted above. The recent paper by Shoji *et al.* said, "Enceladus shows strong evidence that the magnitude of heating is not in steady state."[14] Saying it is not 'in steady state' implies the heat is not enough to sustain liquid water indefinitely.

The argument for episodic increases in tidal dissipation comes from unique orbital resonance phenomena that affect Enceladus. Enceladus is affected by multiple orbit resonances with its neighboring moons, the most significant of which is with the Saturn moon, Dione. There are at least three resonances between the moons Mimas and Enceladus and there is also a resonance between Mimas and Dione. When multiple resonances exist between multiple moons such as this, it is possible, over long periods of time, for one moon (in this case, Enceladus) to transition from one resonance to another, in effect. The resonance that is most important in affecting Enceladus's orbit can change over time. As Enceladus transitions from one resonance to another, the eccentricity of the orbit may increase for a period of time, thus leading to more tidal heating. The greater tidal heating also has a damping effect on the eccentricity change; thus a kind of equilibrium is reached. A study of the long-term behaviour of Enceladus under multiple orbit resonances shows that Enceladus would eventually reach a kind of steady state.[15] This resonance study shows that for approximately 1.3 Ga, Enceladus could undergo orbit oscillations but it moves through the lesser resonances and comes to a more stable orbit in the Dione–Enceladus resonance. These orbit oscillations only change Enceladus's eccentricity by 0.022 at most. Once the more stable state (under the Enceladus–Dione 1:2 resonance) is reached, the changes in its orbit are less and it oscillates stably between two eccentricity limits (varying by about 0.013).[15] This implies the coupled scenario above, assuming steady plus episodic tidal dissipation,[14] is not tenable over multi-billion-year timeframes. Secular science always assumes an old age for the solar system, but this assumption can be an obstacle to good science. Whether there is a 'partial ocean' under Enceladus' surface or not, it is more plausible that there could still be 'warm' liquid water present if Enceladus were only several thousand years old. Enceladus would be a promising topic for further research by creationists.

Ariel

Ariel is one of the 27 known moons of Uranus and is somewhat more than double the radius of Enceladus (table 2). Stereo images were taken by the *Voyager 2* spacecraft in 1986. Some other images have been taken from earth using CCD cameras. Only about 35% of Ariel's surface has been photographed. Ariel has many ridges that are believed to

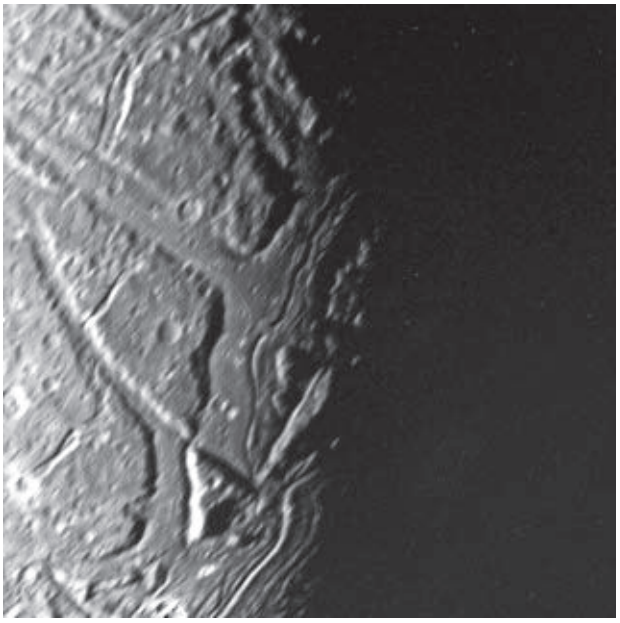

Figure 6. Ridge and valley structures on Ariel's surface. Image is from the *Voyager 2* spacecraft. Image resolution is 2.4 km per pixel.

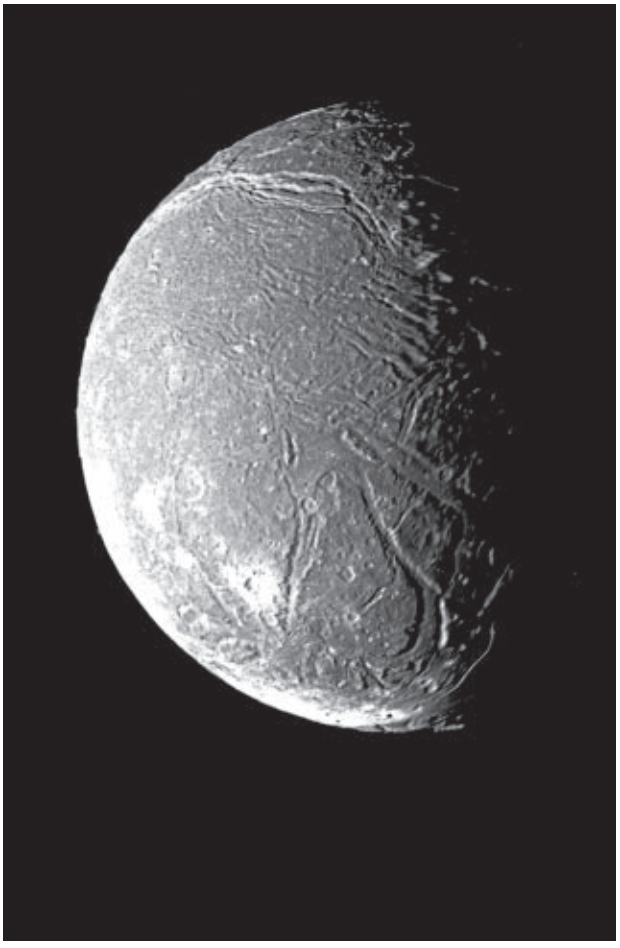

Figure 7. Ariel wide view. Taken by *Voyager 2* spacecraft, January 1986.

be graben structures 3–4 km in depth, formed mainly by normal faults. The graben structures in some cases crosscut crater structures, implying geological activity after the impacts (figure 6). A significant characteristic of Ariel, compared to its neighbouring moons is its low crater density. Two other Uranian moons, Umbriel and Oberon, both have crater densities on their surfaces of about 1,800 per million km^2 (minimum counted diam. 30 km). But Ariel's surface crater density is only 32 per million km^2.[16] Ariel's surface is also brighter than that of the other Uranian moons. Some craters make bright icy rings (figure 7). All this suggests that Ariel has been resurfaced. Ariel is believed to have a silicate core surrounded by an icy mantle and crust.[16] The composition of Ariel's ice is uncertain, although there is spectral evidence of some carbon dioxide ice in addition to water ice.

Estimates of the heat from Ariel are based on indirect calculation from the topographic features. No eruptions have been observed on Ariel. Models generally treat it as a somewhat elastic body and consider ice properties under various stresses implied by surface structures. This approach depends on the assumption that the structures on Ariel are indeed grabens, which behave in a well-understood manner. These methods are perhaps crude but have a legitimate relationship to surface features believed to apply to when the surface features formed. Any conclusions regarding Ariel should be considered tentative at present because there is a need for better data on the moons of Uranus. Estimates give heat fluxes of 28–92 mW/m^2 at the time of formation of the surface.[16] This is a significant amount of energy from a small moon like Ariel. Planetary scientists generally assume a tectonic resurfacing event after the Late Heavy Bombardment (LHB) that did not take place on Umbriel or Oberon. Radioactive heat today is estimated to be 0.6–1.0 mW/m^2. Assuming naturalistic formation of Ariel with Uranus, scientists have estimated radioactive heat could have been as much as 5–8 mW/m^2 shortly after Ariel's formation. Radioactive heat estimates such as these assume a composition of the silicate minerals in the moon to be similar to type CI or LL Chondrite meteorites. Then the estimate referred to as for 'today' is assuming that the decay of the shorter half-life isotopes has ended (after 4.6 Ga) and that only a small proportion of the long-lived isotopes still decays.[17] Such estimates come with old-age assumptions, but even allowing the highest value estimated seems very inadequate for having an energy source sufficient for formation of the surface features.

Today Ariel is not significantly affected by any resonances and TDH would only generate from about one thousandth to one tenth of the required range, above. The possibility of a past resonance with neighbouring moon Miranda has been considered, but in the Uranus system, no

resonance would be long-lasting. Also, such a resonance would affect Miranda much more than Ariel because of Miranda's smaller size. For heat in the range from 28 to 92 mW/m^2 to come from TDH, the eccentricity of Ariel's orbit would have to be greater than its observed value by a factor of approximately 10 to 100. Another scenario considers the possibility that in their formation, Ariel and another Uranian moon, Titania, entered a resonance for a period of time. But even adding radioactive decay in the early solar system to the Titania resonance, this only generates approximately 12 mW/m^2 of heat. Moreover, this resonance would not last billions of years. Thus the authors of the recent paper on Ariel sum up their conclusions this way (from the abstract), "Thus, the origin of the inferred high heat fluxes is currently mysterious."[16]

A creation perspective

Though some popular-level articles on the icy moons of the outer solar system may give the impression that scientists have answered the major questions, examining the technical literature often gives a different picture. An old age of billions of years is merely assumed in solar system research. The icy moons of the outer solar system are a promising topic for further research by young-age creationists. In a solar system only several thousand years old, there could be heat from creation that is still present today, without the necessity of appealing to various orbit changes. This heat from creation may not be from radioactive decay. Tidal resonance is a real process that affects moons in the solar system, but it is not always the most significant heat source. In a young solar system, heat from the Creation Week could still be dissipating and driving geological processes. Tidal dissipation seems insufficient to explain the heat from Europa, Enceladus, and Ariel. Tidal heating has been explored by planetary geologists because it is an ongoing process. However the tendency of moon orbits to move to a stable configuration tends to prevent orbit changes from continuing for billions of years. Thus, it seems that our solar system was created stable, and icy moons are still 'warm' from creation. This is consistent with the solar system being only thousands of years old.

References

1. Spencer, W., Tidal Dissipation and the Age of Io, *Proceedings of the Fifth International Conference on Creationism*, Ivey, R.L., Jr. (Ed.), Creation Science Fellowship, Pittsburgh, PA, pp. 585–595, 2003.
2. Carlisle, C.M., Plumes on Europa, www.skyandtelescope.com/astronomy-news/plumes-on-europa/, accessed 29 April 2015.
3. Researchers study methane-rich plumes from Saturn's icy moon Enceladus, phys.org/news/2015-03-methane-rich-plumes-saturn-icy-moon.html, accessed 29 April 2015.
4. Lewis, J.S., *Physics and Chemistry of the Solar System, 2nd edn*, Elsevier Academic Press, London, UK, pp. 65–68, 2004.
5. Hubble discovers water vapour venting from Jupiter's moon Europa, Science Release heic1322, www.spacetelescope.org/news/heic1322 , accessed 29 April 2015.
6. Roth, L., Saur, J., Retherford, K.D., Strobel, D.F., Feldman, P.D., McGrath, M.A. and Nimmo, F., Transient water vapor at Europa's South Pole, *Science* **343**(6167): 171–174, 2014; doi:10.1126/science.1247051.
7. Rhoden, A.R., Hurford, T.A., Roth, L. and Retherford, K., Linking Europa's plume activity to tides, tectonics, and liquid water, *Icarus* (2015), dx.doi.org/10.1016/j.icarus.2015.02.023.
8. Europa: Facts and Figures, solarsystem.nasa.gov/planets/profile.cfm?Object=Jup_Europa&Display=Facts , accessed 29 April 2015.
9. Bills, B.G., Free and force obliquities of the Galilean satellites of Jupiter, *Icarus* **175**(1):233–247, 2005, doi:10.1016/j.icarus.2004.10.028.
10. Kivelson, M.G., Khurana, K.K., Russell, C.T., Volwerk, M., Walker, R.J. and Zimmer, C., Galileo magnetometer measurements: a stronger case for a subsurface ocean at Europa, *Science* **289**:1340–1343, 2000.
11. Travis, B.J., Schubert, G., Keeping Enceladus warm, *Icarus* **250**:32–42, 2015, doi:10.1016/j.icarus.2014.11.017.
12. Aron, J., Icy moon of Saturn has secret central heating, *New Scientist*, March 14, 2015.
13. Researchers study methane-rich plumes from Saturn's icy moon Enceladus, phys.org/news/2015-03-methane-rich-plumes-saturn-icy-moon.html, accessed 3 May 2015 (article provided by Southwest Research Institute).
14. Shoji, D., Hussman, H., Sohl, F. and Kurita, K., Non-steady state tidal heating of Enceladus, *Icarus* **235**:75–85, 2014, dx.doi.org/10.1016/j.icarus.2014.03.006.
15. Meyer, J. and Wisdom, J., Tidal evolution of Mimas, Enceladus, and Dione, *Icarus* **193**:213–223, 2008, dx.doi.org/10.1016/j.icarus.2007.09.008.
16. Peterson, G., Nimmo, F. and Schenk, P., Elastic thickness and heat flux estimates for the uranian satellite Ariel, *Icarus* **250**:116–122, 2015, dx.doi.org/10.1016/j.icarus.2014.11.007.
17. Hussmann, H., Choblet, G., Lainey, V., Matson, D.L., Sotin, C., Tobie, G. and Van Hoolst, T., Implications of rotation, orbital states, energy sources, and heat transport for internal processes in icy satellites, *Space Science Reviews* **153**(1–4):317–348, 2010, doi:10.1007/s11214-010-9636-0.

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Catastrophic Plate Tectonics and Plate Tectonics—a comparison of two theories

Mark McGuire

Since the advent of *The Genesis Flood* by John Whitcomb and Henry Morris, young-earth creationists have interpreted much of geology through two events, the Creation Week and the Flood of Noah. This is based on the revelation of Scripture. Abundant evidence can be found to support a global Flood as described not only in Genesis chapters 6–9 but also in other biblical references. Several Flood-based models have been proposed. Catastrophic Plate Tectonics is the most prominent today building on the widely accepted Plate Tectonics model in uniformitarian geology. However, Plate Tectonics has some unsolved problems, some of which are significant for Catastrophic Plate Tectonics. Although Catastrophic Plate Tectonics can explain some things better than its uniformitarian counterpart, shortening the timeframe causes other problems. Also, there are subtle differences between the two which can cause confusion when comparing the models. In 1 Thessalonians Christians are instructed to examine ideas carefully. This paper applies this sound advice to both tectonic theories.

Catastrophic Plate Tectonics

Catastrophic Plate Tectonics (CPT) has been developed in recent years to incorporate plate tectonics within a young-earth framework and the Flood year. John Baumgardner is the foremost authority on this subject[1–7] and, in collaboration with many others, has defined a possible solution for the initial cause of the plate movements. The main evidence provided for CPT is runaway subduction, sea floor spreading, and magnetic reversals, which is similar to the uniformitarian plate tectonics (UPT) paradigm, except on a dramatically accelerated timescale. Below is a brief overview of CPT:

> "Geophysically, we begin with a pre-Flood earth differentiated into core, mantle and crust, with the crust horizontally differentiated into sialic craton and mafic ocean floor. The Flood was initiated as slabs of oceanic floor broke loose and subducted along thousands of kilometers of pre-Flood continental margins. Deformation of the mantle by these slabs raised the temperature and lowered the viscosity of the mantle in the vicinity of the slabs. A resulting thermal runaway of the slabs through the mantle led to metres per second mantle convection. Cool oceanic crust which descended to the core/mantle boundary induced rapid reversals of the earth's magnetic field. Large plumes originating near the core/mantle boundary expressed themselves at the surface as fissure eruptions and flood basalts. Flow induced in the mantle also produced rapid extension along linear belts throughout the sea floor and rapid horizontal displacement of continents. Upwelling magma jettisoned steam into the atmosphere causing intense global rain. Rapid emplacement of isostatically lighter mantle material raised the level of the ocean floor displacing ocean water onto the continents. When virtually all the pre-Flood oceanic floor had been replaced with new, less-dense, less-subductable, oceanic crust, catastrophic plate motion stopped. Subsequent cooling increased the density of the new ocean floor, producing deeper ocean basins and a reservoir for post-Flood oceans."[8]

Furthermore, the CPT model, as with the UPT model, uses the timings of the geologic column for determining the sequence of geologic events. It is not the intent of this paper to examine the fossil record/geologic column except to note how it relates to the diluvialist position. Snelling, one of the leading advocates for CPT, states that the geologic column is a physical reality and the "Law of Faunal Succession" applies, at least from the Cambrian to the present.[9] However, this has been questioned by others including Woodmorappe, Reed, Klevberg, Froede, and Matthews.[10–12]

Do unsolved problems in UPT go away in the CPT model?

I have previously discussed how UPT has many ongoing issues that still need to be addressed, and that these also impinge on the CPT model.[13] For example, how many plates are there? There are over 70 documented plates and sub-plates. Baumgardner used approximately 11 plates in his computer model but what about the other 60 plus plates? How would the addition of these extra plates affect the model? Did these other plates form before, during, or after the Flood? Part of the problem is that plate boundaries are not always well defined. The Alpine system, as defined

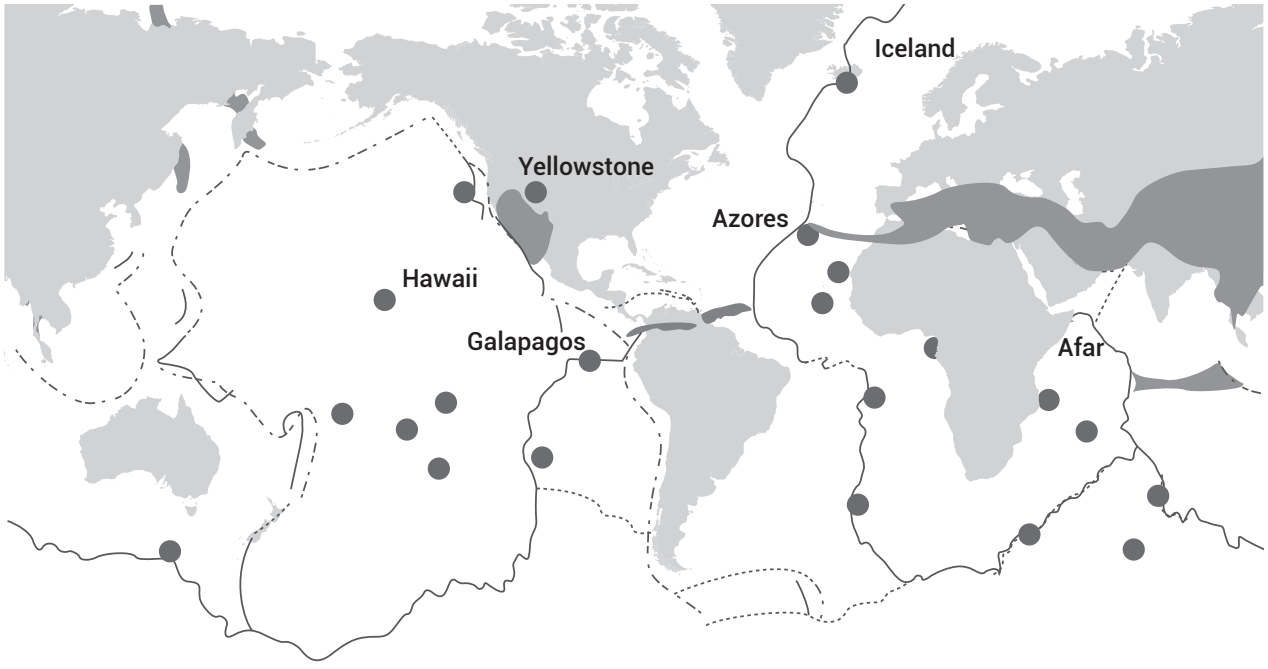

Figure 1. Plate boundary zones—shaded areas are broad belts in which deformation is diffuse and boundaries are not well defined

by Strahler, is very complex geologically and many sub-plates (as many as twelve) are added to fit the data.[14] There is a broad zone running from Europe all the way to China where boundaries are not clearly defined (figure 1). These are mountainous regions that do not fit the standard UPT proposal of colliding plates.[15] Does CPT clarify this and offer a better solution?

Also, folding (bending) of rocks at subduction zones produces high stresses, and different models have been proposed, based both on elastic and plastic behaviour, to reduce the stresses.[16] Evidence exists that normal faulting has occurred in the Japan Trench.[17] If normal faulting has occurred how would this change the model?

Moreover, how does CPT explain the Tibetan Plateau? Its great height is generally considered to be caused by a thickened continental crust. In the UPT model, there are at least three hypotheses for this, with one being delamination of the Eurasian Plate so the crust goes over the Indian Plate and the mantle goes under it.[18] There seems to be no clear answer to the problem. If it is uncertain in the UPT model, then has it been solved in the CPT model?

Furthermore, there are inconsistencies in plate movements which do not correspond with expected motions and could be interpreted as local or regional displacements. The San Andreas Fault has widely varying movements, which questions the postulate that plates are rigid, which is essential for plate tectonics to work.[19] Does CPT resolve this issue? What happens if plates are not rigid?

Lastly, in UPT paleomagnetic stripes on the ocean floor are depicted as magnetic reversals, whereas they are more appropriately described as magnetic anomalies or variation in intensity. These variations are usually depicted in uniform zebra stripe patterns (figure 2) but this is not an accurate representation.[20] The Great Magnetic Bight in the northern Pacific and the Phoenix lineations in the southern Pacific exhibit magnetic striping patterns which do not fit the proposed movement of existing

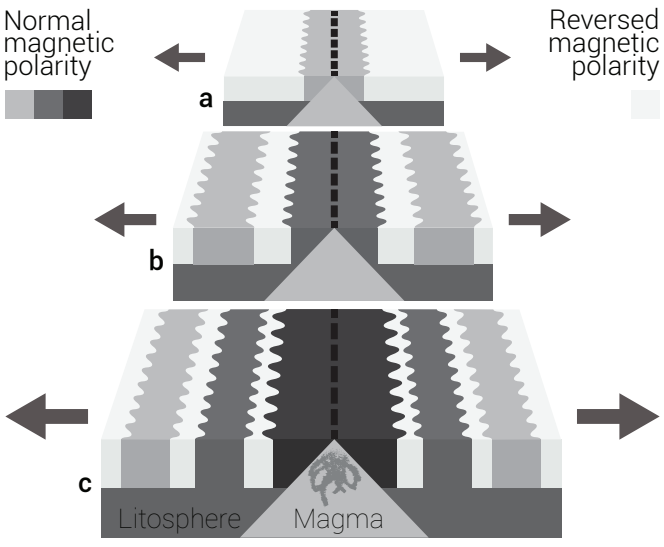

Figure 2. Idealized pattern of magnetic striping

plates, so additional plates, the Kula Plate and the Phoenix Plate, were added to explain the data. However, these plates have since disappeared.[21] Does the data support this or were these plates *ad hoc* additions to make the model work? Does CPT require the addition of these unobserved plates or does it offer a different solution?

These are just some of the problems in the UPT model which have not been resolved. The question is whether these problems disappear in the CPT model with its shortened timescale. For this paper, if something has not been specifically addressed by CPT advocates, then I have used the same explanations for CPT as used in UPT, except on a greatly accelerated timescale.

Problems caused by a shortened timescale

Amount of slab subducted

According to UPT, the supercontinent Pangea broke into separate continents about 200 Ma ago. However, the model assumes that continents have been moving over the earth for billions of years with repeated collisions and breakups, a process that has been called the Wilson Cycle.[22] Paleomagnetic data and the geologic column are used to locate the position of the continents prior to the last great supercontinent of Pangea. Plots of apparent polar wondering (APW) show that Africa was located over the South Pole at one time.[23] Also, Europe and North America took a circuitous path before eventually meeting around 200 Ma ago before the final breakup of Pangea.[24] The question then for Flood geologists is—was Pangea the original earth formed on Day 3 of Creation Week? If so, then how does CPT explain APW paths of the continents? If not, how did all the continents move around within 1,656 years between creation and the Flood, or did this happen as part of the Flood?

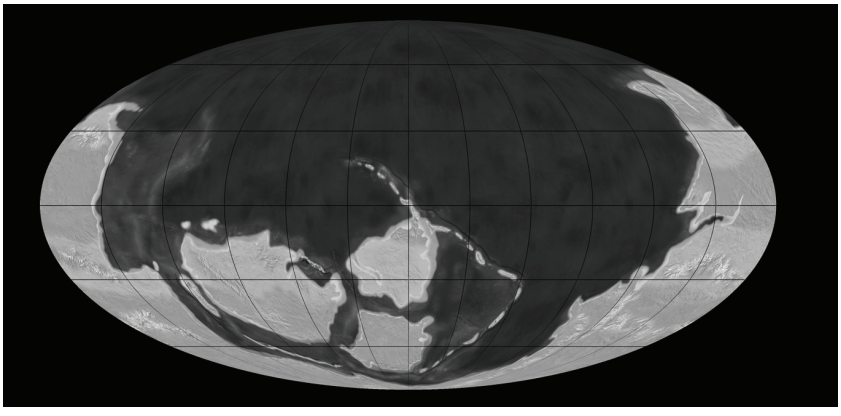

Figure 3. Map of the Cambrian continents at 540 Ma according to the uniformitarian timescale—from www.jan.ucc.nau.edu/rcb7/540moll.jpg. Note this is slightly different from the GTS 2012 map

Baumgardner briefly addresses this problem and states that CPT "emphatically" includes the Paleozoic and the Wilson Cycles. He estimated that it took about two weeks for the opening and closing of the Iapetus Ocean between North America and Europe.[25] There is no mention whether all other movement from the Cambrian (or earlier) in other parts of the world took place during this time. If CPT follows UPT then this is the case, and in the Cambrian approximately 85% of the earth's landmass was located in the southern hemisphere (figure 3).[26]

From that point until the assembly of Pangea in the Jurassic it is estimated that at least 60% of the earth's crust[27] was subducted in order for this movement to take place. Then from Pangea until the present all the oceanic crust was subducted, which was approximately 70% of the earth's crust. According to most uniformitarian geologists the oceanic lithosphere is eventually assimilated back into the mantle at a depth of about 660 km.[28] However, in the CPT model it is proposed that the slab descends to the core–mantle boundary and is deposited as a slab graveyard.[29]

Apparently, there is evidence from seismic images that indicates there are huge slab graveyards at the core–mantle boundary under subduction zones.[30] How big are these slab graveyards? According to CPT the slab goes through the mantle and hits the mantle–outer core boundary. The slab is still considered cold here and not yet 'melted'.[31]

One important issue with this scenario concerns the volume of the subducted plate. The surface area of the earth is about 514,775,000 km^2. Approximately 669,000,000 km^2 must be subducted in 40–150 days. That is enough crust to go around the earth's core four times![32] To put this in perspective, most of the subduction zones are in the Pacific Ocean and the ring of fire is approximately 40,000 km long.[33] The area of the Pacific is 166,242,000 km.[34] On average 4,160 km/km of crust was subducted. The mantle is only 2,900 km thick. What happens when the crust reaches the core (figure 4)?[35] Does subduction stop or does the slab continue to accumulate in these 'graveyards'? What happened to the other 500,000,000 km^2 of slab? Where are all the other subduction zones or did they all disappear as postulated for the unobserved Kula and Phoenix Plates?

The problem only increases if the Ediacaran and other periods are included into the CPT model. Uniformitarians have spent a great deal of time and effort identifying where the plates were prior to Pangea. Do CPT advocates agree with their

maps?[36] If not, where do they diverge? We do not know the initial conditions of Day 3 of creation nor the pre-Flood earth, so where is the break point between CPT and UPT—the Ediacaran? The Cryogenian? CPT computer modelling depends heavily on initial conditions and at this time only starts with Pangea. Does that mean that anything prior to that is only speculation and conjecture? If the computer model depends on initial conditions and we do not know what those initial conditions were, then CPT is not a complete Flood model and further work is needed, including the exploration of alternatives.

Amount of sediment

It seems as though the amount of sediment deposited early in the Flood is a problem for CPT. Snelling puts the pre-Flood/Flood boundary at between 740–700 Ma according to the uniformitarian timeframe.[37] The amount of sediment in the Appalachians is thousands of metres thick, 8,000 m in places,[38] and could have been as much as 18,000 m thick.[39] In the UPT model, this sediment was deposited *prior* to the break up of Pangea. The corresponding mountains and folds reflect the Wilson Cycle in which the Atlantic Ocean was open, then closed, then opened up again. The formation of the Appalachians in the CPT model is summed up as follows:

> "Subsequent collisions of continental fragments at subduction zones are the likely mechanism for the formation of mountain fold-and-thrust belts, such as the Appalachians, Himalayas, and the European Alps. The rapid deformation, burial, and subsequent erosion of early-formed mountain belts within the year of the Flood, at this orders of magnitude acceleration of geologic processes, would seem to provide the only adequate explanation for the existence of high-pressure, low-temperature minerals in the rocks in the cores of these deeply eroded mountain belts."[40]

The mechanisms for the formation of mountains and fold belts may be easier explained in the CPT model, but their timing is not. Apparently, this vast amount of sedimentation needed to occur within the first few days of the Flood with the first cycle of the Wilson Cycle occurring in the first two weeks. The dramatic movement of the North American continent at metres per second, first one way then another, would seem to be erosive in nature and not depositional. It is generally assumed that the sediment in the Appalachians came from the east[41] but it is not clear in the CPT model which direction the water was flowing at this time. It is possible that this area had not even been covered by water as it took at least 40 days and possibly 150 days before the entire globe was inundated. That such extreme geophysical activity occurred during the Flood is a given, but scenarios that are not explicitly described in Scripture need to be examined.

Sea floor spreading and the Mid-Atlantic Ridge

Would following the UPT model (except of course the timeframe) cause a problem at the Mid-Atlantic ridge (MAR) and in the Atlantic Ocean? On the average the Atlantic is 4,270 m deep[42] and the mid-Atlantic Ridge is approximately 10,000 km long.[43] In the UPT model the spreading rate is about 2.5 cm/year[44] so the ocean basin fill and flow rates would be imperceptible.

However, this is not the case for CPT because the Atlantic is opening up at m/sec and moves 6,400 km in some places within 40 to 150 days. As a result, a great amount of water is needed to fill the ocean. At the initial break up of Pangea, at what depth is the newly formed oceanic crust? Was it at the current ocean floor or was it at or above sea level (figure 5)? According to the CPT/UPT model, North

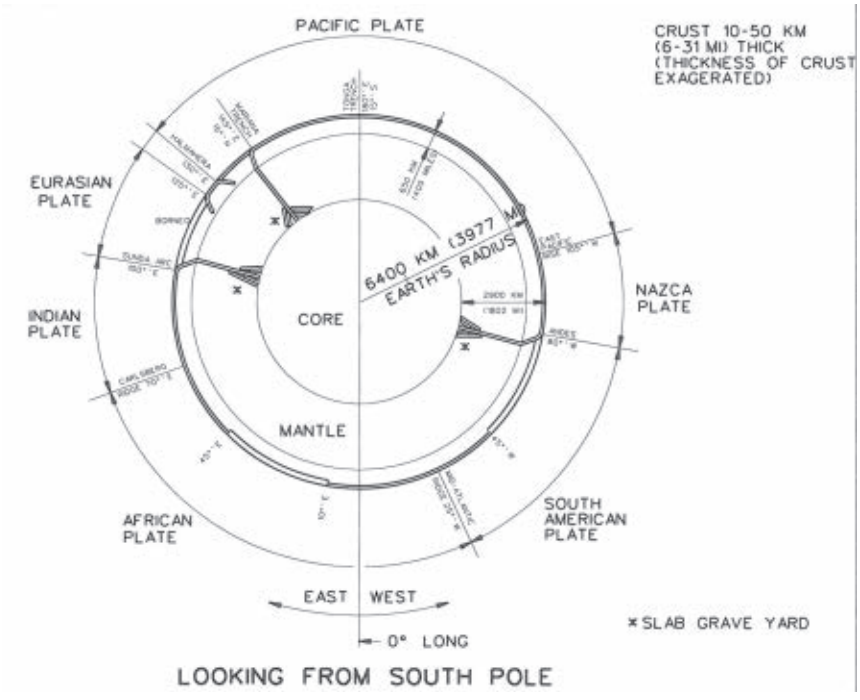

Figure 4. Plate subduction. Subducted slab passes through the mantle to the core–mantle boundary.

America moves first. Presumably, the initial water would come from the Tethys Sea draining into it from the east through the Gibraltar Straight and over southern Europe, and then by water from the west from the Pacific Ocean flowing over Central and North America. South America then moved next with the water coming from the newly formed Atlantic to the north and from the Pacific Ocean around Cape Horn or the Cape of Good Hope.[45] Later, water would come from the west over South America. This would be as a result of the raising of the oceanic crust and subsidence of continental crust next to subduction zones in the Pacific. Further, that same model also showed that the oceanic crust in the Atlantic would rise and portions of the mid-Atlantic Ridge would be above sea level.[46] Note that present-day sea level is being used as a reference as water during the Flood would be above current sea level.

One thing to consider is how 4–7 km of oceanic crust in an ocean basin with little or no water could cool fast enough to be pulled at a rate of metres per second without splitting apart. Without sufficient cooling we would expect it would still be in a fluid (magmatic) state. One mechanism[47] that has been put forward to allow new oceanic crust to cool rapidly suggests that steam jets, based on a column of water 1 km deep, with a velocity of 14 km/sec,[48] could cool a 30-km rock column by 1,000 K.[25] In other words it would cool very quickly. The question is where did this 1-km column of water come from? How long does it take for water from the Tethys Ocean to get to the MAR, especially given the condition that the ridge is moving eastward away from it at m/sec?[49] If there was a 1-km column (or less) of water in the newly formed basin, how would it change crustal cooling?

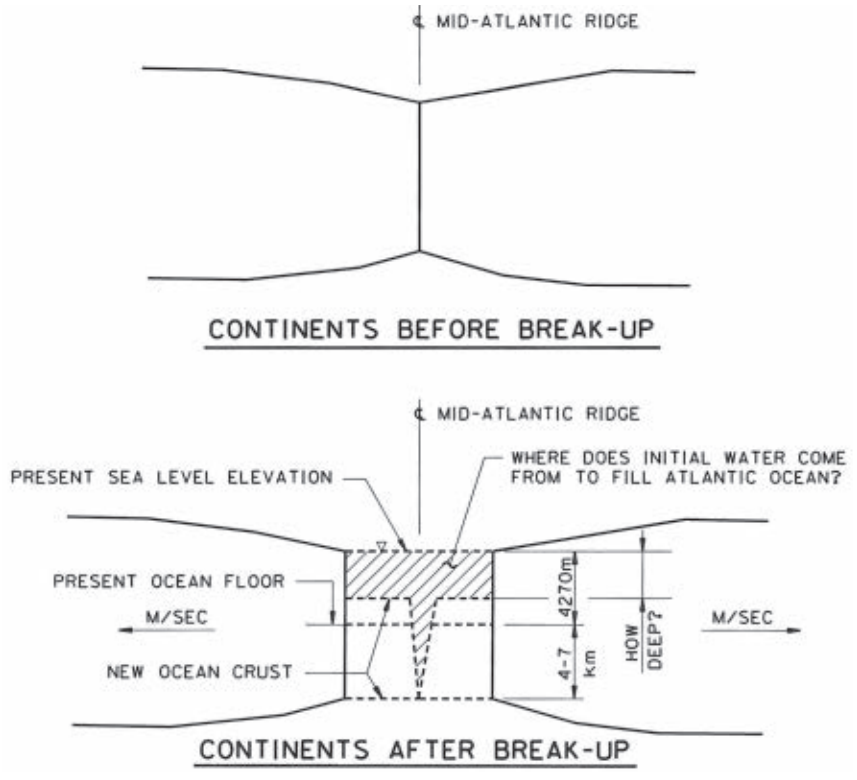

Figure 5. Mid-Atlantic Ridge as the supercontinent Pangea broke apart. Where did the initial water come from to fill the Atlantic Ocean?

Magnetic anomalies and magnetic reversals

In the UPT model it is universally accepted that magnetic reversals have taken place in the past. However, this is by no means certain because anomalies in rocks could be caused by any number of processes, including physical and chemical processes, which occurred at a large scale during the Flood.[50] The possibility of reversals can be accommodated in the Whitcomb–Morris (WM) model[51] if they indeed happened but they are not necessary in that model.

If reversals did happen in the past, then one possible mechanism for them is convection currents in the earth's core.

> "Irving (1966) has also suggested that the magnetic field would reverse frequently during times of active convection and tectonism (e.g. in the late Cenozoic)."[52]

Humphreys has proposed a model for magnetic field reversals based on heat differential and corresponding convection flows that occurred during the Flood.[53] In the CPT model this mechanism would be caused by subducting slabs hitting the core.[54]

According to UPT, the evidence of magnetic anomalies is there at the very start of sea floor spreading, which would correspond with Day 1 of the Flood. If that is the case, then this may be an argument that the reversals were not caused by subducting slabs but by the tremendous amount of tectonism which caused the convection currents at the onset of the Flood, as suggested above. That a great cataclysm happened during the Flood is a basic assumption for both the CPT and WM models. How the temperatures in the earth's mantle varied during the Flood is a matter of speculation. The breaking up of the great deeps could have the same effect on the earth's mantle as subducting slabs and such a model could be applied to it as well.

Furthermore, how fast did the new ocean crust cool below the

Curie temperature in order for it to be magnetized? In the CPT Flood model the oceanic crust was placed within 150 days. Although crustal cooling could be rapid, is it possible that the new ocean crust had not cooled enough to be magnetized before the reversals finished? If it cooled instantly, then what effect does the magnetic field have on the rock, as the grains would be 'frozen' in whatever orientation they happened to be in and magnetism would have little or no effect on the rock?

To sum up, magnetic reversals and magnetic anomalies are used as major evidence for plate tectonics and sea-floor spreading but they involve a great deal of speculation. Magnetic anomaly patterns are far from the idealized sketches that are often shown in text books and could be explained without the interpretation of sea-floor spreading or magnetic reversals. But if magnetic reversals did occur they certainly can be accommodated in either the CPT or WM models.

Differences between CPT and UPT

Mechanisms used to move slabs

Superficially, CPT is very similar to UPT but there are some subtle but important differences between the two. One difference concerns the forces required to move the plates horizontally. UPT appeals to a number of forces with 'slab pull' and 'ridge push' being the two dominant ones. At one time convection currents in the earth's mantle were thought to be a major force in the movement of plates.[55] The question arose as to whether the slab drags the mantle, or whether the mantle drags the overlying slab. This idea was seriously questioned in the 1970s by Soviet geophysicist E. Artyushkov. He argued that the viscosity between the lithosphere and the asthenosphere was significantly reduced and the force of a convection current was much too weak to be significant.[56] Eventually, the convection current dragging the lithosphere idea was abandoned so that the two dominant forces are slab pull near subduction zones and ridge push at plate spreading.[57] In CPT, the major driving forces are also slab pull and ridge push,[58] although mantle flow plays a major role, too.

Runaway subduction

Some of the problems of UPT can be better explained though CPT, and one of these is the mechanism for plate movements, which is provided by runaway subduction. Runaway subduction is explained as follows:

> "The combination of a gravitational body force acting on a cold slab of ocean lithosphere that possesses potential energy to release as it sinks within a lower density medium that weakens as the stress level increases provides the essential elements needed for an episode of runaway sinking. If the initial conditions allow the slab to begin sinking at a rate sufficient to heat the material immediately surrounding the slab at a rate that exceeds the rate of heat loss by thermal diffusion, this surrounding zone weakens, allowing the slab velocity to increase further, ultimately resulting in sinking rates many orders of magnitude higher than the normal strength of the rock would allow"[59]

That a cold, dense slab can sink is not disputed, and even that the rate can be increased many times, but could this not be applied to other possible Flood models, such as the WM vertical tectonics? Runaway subduction is based on gravity, heat flow, and the properties of the rock.[2] Gravity, the main driving force to begin runaway subduction, acts in a radial (vertical) direction towards the centre of the earth. Horizontal movement comes from the plate being pulled sideways by the runaway subduction.[60] In order for plates to be pulled along in this manner it means that they are in tension.

> "A second major geological constraint concerns the large lateral displacements of the cratonic blocks that also occurred during the Flood. From a stress distribution standpoint this requirement of translating continental blocks by thousands of kilometers in a short period of time severely constrains candidate mechanisms because it involves the solid-state deformation of the rock in the mantle below. That craton interiors display so little Phanerozoic deformation despite the fact the cratons traversed such vast distances so rapidly means that stress levels within the cratons never approached the fracture or yield limits and that the forces responsible for moving these huge bodies of rock were diffuse and relatively uniform over the area of the block. Mechanisms that move the plates by applying forces at their edges cannot produce the general absence of deformation in the craton interiors. The only conceivable mechanisms able to move plates so far and so rapidly with hardly any internal deformation are those that involve large scale flow in the earth's mantle and that apply relatively mild and uniform tractions on the base of the plates. This constraint as well as the previous one both point to catastrophic overturning of the mantle driven by gravitational potential energy in large volumes of cold rock at the earth's surface and/or in the upper mantle and assisted by a runaway instability resulting from a temperature and stress dependent deformation law for silicate rock."[61]

This brings up two points. First, that plates are in tension is a problem for both UPT and CPT. Rocks are weak

in tension, and slabs being pulled along would be under a great deal of tension. There is also a high tensional stress on the top of the plates produced when the plates bend at sharp angles at the subduction zones and this would add to the tensional stress. If the stress exceeds the rock strength the rock will break. There is evidence that normal faulting has occurred in the Japan Trench.[16] Would subduction stop when such faulting occurs? UPT has the benefit of long ages so that the tension would be applied slowly and ridge push would help reduce the stress. However, CPT does not have that luxury as the plates are moving at metres per second. As noted above, the huge force required to move the plates cannot be applied at its edges as it would cause crushing on the compression side and cracking and pulling apart at the tension side. The only way it could be done is if there is large-scale mantle flow. Baumgardner, in his computer models, shows a mantle flow moving at metres per second.[31] Apparently, mantle flow is doing most of the work of dragging the slab. It is obvious that CPT advocates have these two mechanisms—runaway subduction and mantle flow—acting simultaneously. This is in sharp contrast to UPT and must be kept in mind when examining and comparing the models.

Second, it was assumed that the only way that cratons could have such little deformation is through large-scale flow in the mantle and low traction force. But there is another possibility for why such little deformation occurred in the cratons and that is that there was little or no horizontal movement at all.

Spreading ridge movement

Concerning the westward movement (assuming Africa is fixed) of the American Plate(s), it is not exactly obvious how this happened. UPT advocates propose that the plate moved toward the subduction zone. CPT advocates use a similar explanation. This 'enigma' was debated several years ago by Froede and Baumgardner. Froede pointed out that the UPT model usually shows a spreading ridge on one side of a plate with a corresponding subduction zone on the other.[62] Obviously, this is not the case with the African plate. One of the solutions to this problem is an asymmetrical movement of the mid-Atlantic ridge. That is, the ridge is not stationary but mobile, and moves at such a rate that produces symmetrical magnetic striping patterns as well as moving westward away from Africa.[63] Baumgardner's response was similar except that he referred to his computer model, which showed that the mid-Atlantic ridge could migrate in this manner.[49] Froede, however, pointed out that ridge migration is only one possible solution to the problem, and that there is no clear consensus among UPT advocates. He also pointed out that an asymmetric ridge requires a mobile source plume, which was not originally predicted in the model nor has it been demonstrated since.[64] Does the data show that asymmetric movement has occurred or is it required by UPT/CPT to make the models work? For instance, there are no hot spot tracks similar to the Hawaiian-Emperor Island chain on either side of the Mid Atlantic Ridge at Iceland. Also, has this migration occurred at the Reykjavik Ridge in Iceland? Even if there was evidence of movement there could be other explanations. There are many active volcanoes on Iceland and each eruption would change the topography of the area to some degree. Earthquakes could have the same effect as well.

Furthermore, Antarctica is surrounded by spreading ridges except for a small subduction zone at the tip of South America and a transform boundary at the Scotia plate. Spreading zones account for almost 90% of the boundary, the subduction zone less than 4%, and the transform boundary about 7%. There are no compensating subduction zones. Apparently, the subduction zones have since disappeared under Antarctica.

> "In the case of Antarctica, it moved mostly southward, away from Africa and Australia, and overrode a zone of subduction that was previously on its south coast (just as North America has overridden a zone of subduction that was previously along its west coast). So in the case of Antarctica, there actually is a compensating subduction zone. It is simply hidden from view today and no longer active."[65]

How are we to know if a hidden, once-active zone is now inactive? This is the mechanism of the disappearing plate which UPT advocates invoke to explain the data.[66] Does the data reflect this or is this simply required for the UPT/CPT models?

Computer modelling

Lastly, as far as computer models go, they are wonderful tools, but they have their limitations. For example, UPT advocates have developed computer models such as the NUVEL-1 program, which was generated in the early 1990s. It is a complex model using over 1,000 data items, including 277 plate-spreading rates based on magnetic anomaly data, 724 earthquake slip vectors and 121 transform-fault azimuths. The results of their model demonstrated that plates move uniformly over long periods of time, meaning millions of years.[67] Would any young-earth creationist agree with that assessment? Doesn't this model depend on initial conditions and current spreading rates? But it is based on the assumption that motions have been uniform over long periods of time but is this valid? Computer applications are a powerful tool to help in understanding processes, but these do not do away with the need to examine everything carefully. Baumgardner's work is to be commended. However, it is based on certain assumptions such as that plates are rigid and they move considerable distances in a short timeframe. This validates CPT and shows that it is possible. The issue is

not with the model but with the assumptions used—that plates are rigid and they have moved great distances. There is a growing minority in the uniformitarian community who do not agree with these assumptions and consider the earth's crust as inhomogeneous with properties that vary widely.[68]

Summary and conclusions

CPT is basically a condensed version of UPT. However, CPT does not address many of the problems in the UPT model, including the number of plates, plate boundaries, plate motions, and paleomagnetism. CPT appears to have solved the initial break-up of the earth's continents but it has unique problems of its own due to the shortened timescale. Magnetic reversals are by no means certain and the magnetic anomalies in the rocks could have a number of causes. If reversals did occur they could easily be explained in either the CPT or WM model. Finally, there are subtle differences between CPT and UPT, but not all issues have been specifically addressed by CPT advocates. In such cases we have to assume that CPT follows the UPT explanations only on a vastly accelerated timescale. At times, this requires careful evaluation when comparing the two models.

Geology is complex and historical geology even more so. In uniformitarian geology there are many models which are not much publicized, including expanding earth, contracting earth, surge tectonics, along with several others. These all make valid points based on observed field data. However, they cannot all be true. Currently, uniformitarian plate tectonics is the 'consensus' of most scientists to the point where other models tend to be ignored or ridiculed. But there is a danger, as noted by Lowman

> "Perhaps the most damaging tactic that can be used in scientific controversies is to ignore contradictory evidence, anomalies and dissenting view."[69]

It is important for diluvialists to present a plausible, detailed model to the world. At the present time there are several Flood models that have been proposed, including CPT, WM, Walt Brown's hydroplate model, the impact model, among others. They cannot all be true but each one makes valid points. The question is should diluvialists restrict themselves to a single model based on consensus science or continue with multiple hypotheses until the truth is obtained? The Bible is the key to understanding the past. Unfortunately, the Bible does not go into geologic detail about the Flood so we cannot be dogmatic. Thus, we should continue to explore multiple alternatives until the truth can be determined. The aim of this paper, by pointing out problems that need to be addressed, is to help in this process. If we can solve these problems, then the main objective of presenting a viable Flood model to the world can be achieved.

Acknowledgments

First of all, I would like to thank Mike Oard, Shaun Doyle, Tas Walker and several anonymous reviewers for reviewing these articles and for their many suggestions and comments. It helped me to dig a little deeper and to rearrange some things to hopefully make these articles a little clearer. Any errors or omissions in these articles are my own.

References

1. Baumgardner, J.R., Computer modeling of the large-scale tectonics associated with the Genesis Flood; in: Walsh, R.E., (Ed.), *Proceedings of the Third International Conference on Creationism, Technical Symposium Sessions*, Creation Science Fellowship, Pittsburgh, PA, pp. 49–62, 1994.
2. Baumgardner, J.R., Runway subduction as the driving mechanism for the Genesis Flood; in: Walsh, R.E., (Ed.), *Proceedings of the Third International Conference on Creationism, Technical Symposium Sessions*, Creation Science Fellowship, Pittsburgh, PA, pp. 63–75, 1994.
3. Baumgardner, J.R., 3-D Finite Element Simulation of the Global Tectonic Changes Accompanying Noah's Flood; in: Walsh, R.E. (Ed.), *Proceedings of the Second International Conference on Creationism, Technical Symposium Sessions, Volume II*, Creation Science Fellowship, Pittsburgh, PA, pp. 35–42, 1990.
4. Baumgardner, J.R., Catastrophic Plate Tectonics: the Geophysical Context of the Genesis Flood, *J. Creation (TJ)* **16**(1):58–63, 2002.
5. Baumgardner, J.R., Dealing Carefully with the Data, *J. Creation (TJ)* **16**(1): 68–72, 2002.
6. Baumgardner, J.R., A Constructive Quest for Truth, *J. Creation (TJ)* **16**(1): 78–81, 2002.
7. Baumgardner, J.R., *Planetary Cataclysm,* Creation Ministries International, video, 2008.
8. Austin, S.A., Baumgardner, J.R., Humphreys, D.R., Snelling, A.A., Vardiman, L. and Wise, K.P., Catastrophic Plate Tectonics: A Global Flood Model of Earth History; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism, Technical Symposium Sessions*, Creation Science Fellowship, Pittsburgh, PA, pp. 609–622, 1994. This article can be accessed on the internet at http://www.icr.org/article/catastrophic-plate-tectonics-flood-model/.
9. Snelling, A.A., *Earth's Catastrophic Past: Geology, Creation and the Flood, vol. 1*, Institute for Creation Research, Callas, TX, p. 321, 2009.
10. *The Geologic Column: Perspectives within Diluvial Geology*; Reed, J.K. and Oard, M.J. (Eds.), Creation Research Society Books, Chino Valley, AZ, 2006.
11. Woodmorappe, J., *Studies in Flood Geology*, Institute for Creation Research, El Cajon, CA, 1999.
12. Matthews, J.D., The stratigraphic geological column—a dead end, *J. Creation* **25**(1):98–103, 2011.
13. McGuire, M., Plate tectonics–inconsistencies in the model, *J. Creation* **28**(2):104–115, 2014.
14. Strahler, A.N., *Plate Tectonics*, Geo·Books Publishing, Cambridge, MA, pp. 314–316, 1998.
15. Ollier, C., and Pain, C., *The Origin of Mountains*, Routledge Publishing, London, UK, 2000.
16. Watts, A.B., *Isostasy and Flexure of the Lithosphere*, Cambridge University Press, New York, pp. 162–174, 2001.
17. Watts, ref. 16, p. 169.
18. Strahler, ref. 14, pp. 325–326.
19. McGuire, ref. 13, pp 108–112.
20. Fischer, J.M., Seafloor Magnetic Stripe: Look Again, p. 14; http://www.newgeology.us/presentation25.html, accessed 8 February 2011.
21. Strahler, ref. 14, pp. 248–251.
22. Strahler, ref. 14, pp. 11–13.
23. Strahler, ref. 14, p. 524.
24. Strahler, ref. 14, pp. 533–535.

25. Baumgardner, J.R., CPT emphatically includes the Paleozoic, *J. Creation (TJ)* **17**(2):62, 2003.
26. Gradstein, F.M., Ogg, J.G., Schmitz, M.D. and Ogg, G.M., *The Geologic Time Scale 2012*, *vol. 2,* Elsevier BV, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK, p. 437, 2012. Note that there are some slight differences between their map and the one shown in figure 3, which was drawn by Dr Ron Blakey of Northern Arizona University.
27. I estimated this based on the movement as shown in the geologic maps from Gradstein *et al.*, from the Cambrian (514 Ma) to the Triassic (237 Ma). It is a conservative estimate and could be much greater.
28. Strahler, ref. 14, p. 84.
29. Snelling, A.A., *Earth's Catastrophic Past: Geology, Creation and the Flood, vol. 2*, Institute for Creation Research, Callas, TX, p. 694, 2009.
30. Wysession, M.E., Imaging cold rock at the base of the mantle: The sometimes fate of slabs? in: Bebout, G.E, Scholl, D.W., Kirby, S.H., and Platt, J.P., Eds., *Subduction Top to Bottom*, American Geophysical Union, Washington, DC, pp. 369–384, 2013.
31. Baumgardner, ref. 4, p. 60.
32. The surface area of a sphere is $4\pi r^2$. The surface area of the earth based on r = 6,400 km is 514,775,000 km^2; 70% of that is 360,342,000 km^2, which is the amount subducted from Pangea to the present. 60% of the surface is 308,865,000 km^2, which is the amount subducted from the Cambrian to the Triassic. The total subducted slab is 669,000,000 km^2. The surface area of the core is based on r = 3,500 km = 153,938,000 km^2. The area of the subduction divided by the area of the core = 4.34.
33. Ring of Fire, en.wikipedia.org/wiki/Ring_of_Fire, accessed 4 October 2014.
34. *The World Almanac and Book of Facts 2002*, World Almanac Books, 512 Seventh Avenue, New York, 10018, p. 456. 2002.
35. Bardwell, J. (Ed.), *The Flood Science Review*, In Jesus Name Production Inc., pp. 169–173, 2011. This question was asked during the forum but was never addressed. Baumgardner's response was dealing with the Wilson Cycle and not with subducted slab and what happens when it hits the core–mantle boundary.
36. Gradstein, *et al.*, ref. 26.
37. Snelling, ref. 29, p. 710.
38. Strahler, ref. 14, p. 395.
39. Oard, M.J., Origin of Appalachian geomorphology: Part I: Erosion by retreating floodwater and the formation of the continental margin, *CRSQ* **48**(1): 33–48, 2011, pp. 35, 40.
40. Snelling, ref. 29, p. 695.
41. Snelling, ref. 29, p. 701.
42. Burt, W.V., Atlantic Ocean, *The World Book Encyclopedia. Vol. 1*, World Book-Childcraft International, Inc. Chicago, IL, 828, 1981.
43. Descent to Mid-Atlantic Ridge, www.earthguide.ucsd.edu/mar/intro.html, accessed 10 July 2014.
44. Mid Atlantic Ridge, en.wikipedia.org/wiki/Mid-Atlantic_Ridge, accessed 10 December 2014.
45. Strahler, ref. 14, p. 340.
46. Baumgardner, ref. 1, p. 61.
47. Snelling, ref. 29, pp. 983–998.
48. Note: escape velocity for the earth is 11 km/sec not considering atmospheric drag. Is it possible that some of this water / steam jets would escape the earth's atmosphere?
49. Baumgardner, J.R., Have the Continents Really Moved Apart? *J. Creation (TJ)* **15**(3):36–38, 2001.
50. Jacobs, J.A., *Reversals of the Earth's Magnetic Field*, Adam Hilger Ltd, Techno House, Redcliffe Way, Bristol, UK, p. 33, 1984.
51. Whitcomb, J.C., and Morris, H.M., *The Genesis Flood*, Presbyterian and Reformed Publishing Company, Phillipsburg, NJ, 1961, 35th printing, pp. 258–270, 1991. The Whitcomb–Morris model is based on the concept of vertical tectonics with subterranean ground water before the Flood. Also, see *The Henry Morris Study Bible*, Master Books, Green Forest, AR, 2012, footnote under Genesis 8:1.
52. Jacobs, ref. 50, p. 37.
53. Humphreys R.D., Physical mechanism for reversals of the earth's magnetic field during the Flood; in: Walsh, R.E. (Ed.), *Proceedings of the Second International Conference on Creationism, Technical Symposium Sessions, Volume II*, Creation Science Fellowship, Pittsburgh, p. 130, 1990.
54. Snelling, ref. 29, p. 696.
55. Strahler, ref. 14, pp. 81–82.
56. Strahler, ref. 14, pp. 82–83.
57. Strahler, ref. 14, pp. 83–84.
58. Baumgardner, ref. 5, p. 70.
59. Snelling, ref. 29, p. 692.
60. Snelling, ref. 29, pp. 695.
61. Baumgardner, ref. 1, p. 50.
62. Froede, C.R. Jr., The expanding African plate: A problem within plate tectonics and Catastrophic Plate Tectonics; in: Reed, J.K. (Ed.), *Plate Tectonics: A Different View*, Creation Research Society Books, St Joseph, MO, pp. 65–76, 2000.
63. Froede, C.R. Jr., The expanding African plate: A problem within plate tectonics and Catastrophic Plate Tectonics; in: Reed, J.K. (Ed.), *Plate Tectonics: A Different View*, Creation Research Society Books, St Joseph, MO, pp. 65–76, 2000.
64. Reed, J.K., Woodmorappe, J., Froede, C.R. Jr., An Answer to John Baumgardner's Review of *Plate Tectonics: A Different View*, *CRSQ* **39**(3): 203–207, 2002.
65. Baumgardner, ref. 5, p. 71.
66. Strahler, ref. 14, p. 249.
67. Strahler, ref. 14, pp. 239–241.
68. Chekunov, A.V., Gordienko, V.V. and Guterman, V.G., Difficulties of Plate Tectonics and possible alternative mechanisms, *Critical Aspects of the Plate Tectonics Theory Volume II*, Theophrastus Publications, Athens, Greece, pp. 397–433, 1990; p. 404.
69. Lowman, P.D. Jr., Plate tectonics and continental drift in geologic education; in: Chandrasekhar, S. and Hotton III, N. (Eds.), *New Concepts in Global Tectonics*, Texas Tech University Press, p. 8, 1992.

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Intelligent Design leaders promote a naturalistic epistemology[1]

Michael H. Warren

In part 1, I show that Intelligent Design (ID) movement leaders promote a naturalistic worldview in two ways. First, they claim that ID is compatible with atheism because the designer of life on earth could be a finite designer, like a space alien in a world without God, which concedes the reasonableness of the naturalistic worldview that the universe is ultimately determined by matter rather than a Mind. Second, they promote a definition of science and an empiricist view of knowledge that exclude the authority of divine revelation, thus conceding that science and knowledge can be explained without God. But, I then briefly explain, the secular empiricist view of knowledge has been a failure. In part 2, I argue that science is dependent on God and His revelation, not a supposedly theologically neutral scientific methodology. Despite his claim that ID is compatible with atheism, I show how ID leader William Dembski's view of complex specified information is comparable to and only consistent with an intelligent Creator who is the source of human knowledge and the unity and diversity of the world.

Part 1—the finite gods and failed epistemology of Paley and the modern ID movement

William Paley famously opens his book *Natural Theology* by describing a man walking across a heath. Coming across a watch on the ground, he sees that it has a complicated mechanism and concludes that it must have had a designer.[2] The watch is the star of this opening scene but there is another character that should not be overlooked. Paley argues that the watch is designed by contrasting it with a stone he stubbed his toe on prior to finding the watch. He says about the stone: "for anything I knew to the contrary it had lain there for ever".[3] The implication of Paley's story is that the stone does not bear evidence of being created by an intelligent designer. Yet any Christian must affirm that God made the stone. It did not eternally lie there without a maker. To limit God's activity to the complicated aspects of creation, reflective of God's wisdom though they are, denies the sovereign Creator of *all* things taught in the Bible. Paley's design argument, at least without augmentation of some kind, gives us a finite god, a creator of only part of our world. And with a finite god we get a naturalistic worldview because the impersonal forces of matter have an existence and nature that is self-determined and self-explanatory, rather than having their existence and meaning given by the limited creator (or by a sovereign Creator either). The man walking across the field should infer design by some intelligent designer in the watch, but he should also see that the stone was made by an intelligent designer because knowledge of any fact is possible only because all facts in the universe are created by a sovereign God, as I will explain more fully below.

Belief in finite gods undermines the scientific enterprise. Whether we are talking about one finite god or many of them, as we find in the polytheism of ancient mythology, matter's existence and nature is independent of those gods; therefore, Nancy Pearcey's remarks about polytheism are appropriate here:

> "… finite gods do not create the universe. Indeed, the universe creates them. … in a polytheistic worldview, the universe itself is not the creation of a rational Mind, and is therefore not thought to have a rational order … . And if you do not *expect* to find rational laws, you will not even look for them, and science will not get off the ground."[4]

Seeing matter as independent of a rational mind as its creator undermines that which served as the basis of the rise of science in the West. In a famous statement, Alfred North Whitehead argues that the Christian idea of a rational God's creation and control of the universe provided the foundation for the rise of science in the West. He says:

> "The inexpugnable belief that every detailed occurrence can be correlated with its antecedents in a perfectly definite manner … must come from the medieval insistence on the rationality of God … . My explanation is that the faith in the possibility of science, generated antecedently to the development of modern scientific theory, is an unconscious derivative from medieval theology."[5]

Similarly, Thomas Torrence points out how the Christian belief in God's creation and control of all things provided a basis for the thorough rationality of the material world, and therefore for the rise of empirical science, that was lacking

in the dualistic views of ancient Greek philosophy and other ancient religions/philosophies:

> "Christian belief in the goodness and integrity of the physical universe … played an incalculable part in transforming the ancient worldview. It destroyed the Platonic and Aristotelian idea that matter is, if not evil, the raw material of corruption and unreality and the source of disorder in the universe, and it also ruled entirely out of consideration the pessimistic views of nature that emanated from the dualistic sects such as the Manichaeans and the Gnostics, thereby emancipating the material reality of the universe for serious scientific attention."[6]

Defeating naturalism, but welcoming atheism into ID's big tent?

Phillip Johnson, William Dembski and other leaders in the ID movement say that the strategy of ID is to attack the assumption of naturalism in the scientific community.[7] Yet, Dembski says: "The intelligent design movement is linked both conceptually and historically to British natural theology." [8] As we just saw with Paley's analogy of the stone and the watch, the design argument can be stated in a way that implicitly affirms the naturalistic worldview.

So we must ask, do the ID leaders escape the problem of Paley's design argument? Unfortunately not. Despite their stated goal of undermining naturalism, they explicitly affirm the possibility of a finite god. Their attempted *neutrality* on whether the intelligence that designed life on earth is finite or infinite, we will see, is actually a *negation* of the infinite view of God held by Christians and is an implicit affirmation of the naturalistic worldview.

In an ode to Johnson's leadership in the ID movement, Dembski writes: "The ID movement is a big tent and all are welcome. Even agnostics and atheists are not in principle excluded … . I've seen intelligent design embraced by Jews, Muslims, Hindus, Buddhists, agnostics and even atheists."[9] And in another book he writes:

> "But the designer is also compatible with the watchmaker-God of the deists, the demiurge of Plato's Timaeus and the divine reason (i.e. *logos spermatikos*) of the ancient Stoics. One can even take an agnostic view about the designer, treating specified complexity as a brute unexplainable fact. Unlike scientific creationism, intelligent design does not prejudge such questions as *Who is the designer?* or *How does the designer go about designing and building things* [emphasis in original]?"[10]

This raises some questions. If atheists can embrace ID, how is this defeating naturalism? If atheists can embrace ID, why should Christian apologists use it to argue against atheism? If belief in a rational God that created all things is the historical foundation of science, why do ID advocates see themselves as being scientific by being non-committal to the existence of God? By allowing for finite intelligence as the ultimate source of information, the ID leaders are conceding that an ultimately non-rational world, controlled completely by impersonal, material forces, can account for the existence of those finite intelligences that created life on earth. They are conceding to the reasonableness of the naturalistic worldview. Atheistic evolutionists like Francis Crick, Carl Sagan, and Richard Dawkins say that aliens could have created life on another planet, which was then transported to earth.[11] Dembski would require a greater involvement of the space aliens in the creation of life on

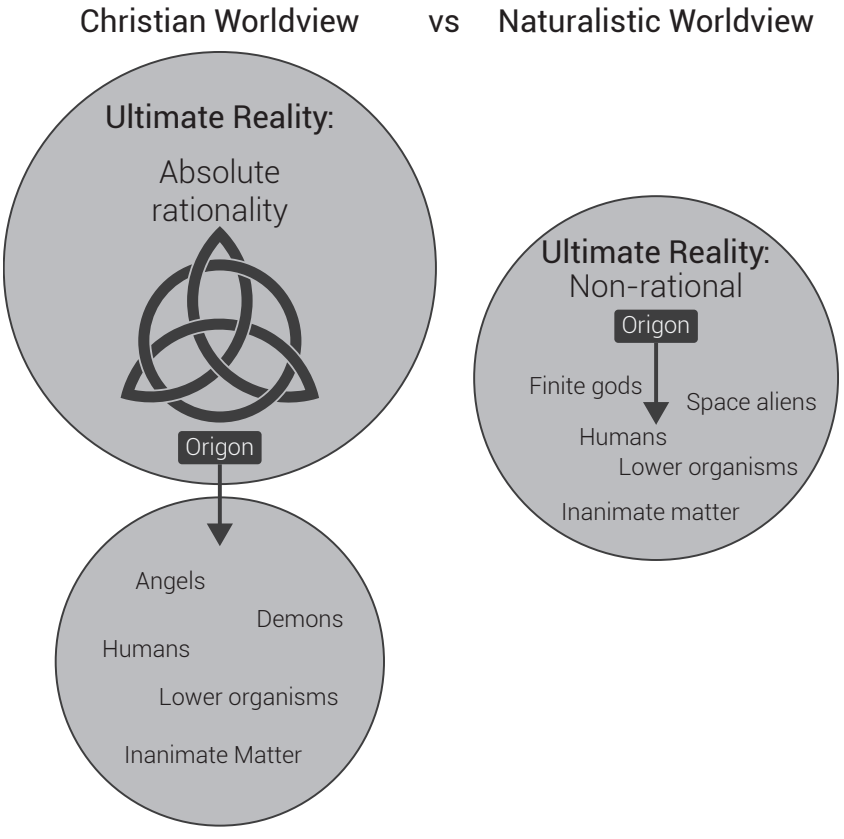

Figure 1. Christian worldview vs naturalistic worldview [Christian-v-Naturalistic-di.jpg]

earth but Dembski's big-tent view of ID is basically the same worldview as those atheists.

Biblically, we should remember that "the God" (*ton theon*—Romans 1:21), not Plato's demiurge or the Stoic *logos*, has been "clearly perceived, ever since the creation of the world, in the things that have been made. So they are without excuse" (Romans 1:20). *If you don't find "the God", an eternal, sovereign Creator, in your study of creation, then you're doing something wrong.* In one chapter in his book *Intelligent Design*, Dembski puts aside his deference to finite gods and considers the implications for ID in terms of the Christian worldview. In this chapter he says, quite rightly: "Naturalism is idolatry by another name. We need at all costs to resist naturalistic construals of *logos* (whether *Logos* with a capital *L* or *logos* with a small *l*)."[12] But, in that case, the ID tent is not big enough to accept naturalistic *logoi*, like Stoicism, Plato's demiurge, and space aliens.

ID leaders define science as empiricism that excludes God and the Bible

The ID leaders also concede to the naturalistic worldview in terms of their definition of science. Dembski says: "Scientific creationism's reliance on narrowly held prior assumptions undercuts its status as a scientific theory. Intelligent design's reliance on widely accepted scientific principles, on the other hand, ensures its legitimacy as a scientific theory."[13] He says that scientific creationism's narrowly held, unscientific prior assumptions include "a Creator who originates the world and all its materials".[13] So once again, how is ID defeating naturalism if it can explain the universe without a Creator?

Dembski says that ID is scientific because it relies on "widely accepted scientific principles." Likewise, Stephen Meyer argues for the "methodological equivalence" between ID and naturalistic evolution.[14] This simply allows sinful men to vote to kick God out of science. The ID advocates have chosen to sit in the seat of scoffers (Psalms 1:1) by sharing that same contempt towards creationists that atheistic evolutionists do. Truth is not determined by majority vote, even a majority vote among scientists, especially in a godless age such as ours in which the majority of the scientific community pride themselves on their godlessness. As I'll explain more fully below, certain widely accepted principles seen as inseparable from science exclude the Christian worldview and actually undermine the possibility of science, so these widely held principles should be rejected by all rational, scientifically minded people.

Dembski claims that science excludes a Creator by definition: "More than rearranging a pre-existing universe, creation originates the universe itself. Consequently creation lies beyond the remit of science."[15] But this is just begging the question of naturalism, at least a methodological naturalism. The only intelligent designer that this definition allows into science is a finite intelligence within the universe. Why should Dembski define science to exclude the Creator? What if a transcendent Creator is exactly what is needed to explain design? If so, Dembski's definition of science prevents scientists from offering the true explanation for nature and prohibits them from giving God the glory due to His name.

Likewise, Meyer writes: "ID is not based on religion, but on scientific discoveries and our experience of cause and effect, the basis of all scientific reasoning about the past. Unlike creationism, ID is an inference from biological data."[16] Meyer equates secular empiricism with science. He is accepting a naturalistic theory of knowledge. What if empirical knowledge of cause and effect requires the God who speaks in the Bible? How can any Christian say that God is not allowed to speak authoritatively on scientific issues? God created the world. He is all-knowing. How can any *Christian* say that we can ignore God if He gives us knowledge about His creation? Johnson, Dembski, and Meyer identify themselves as Christians. To put it bluntly, *who do they think they are to tell God to shut up and butt out of science?* A god who cannot communicate to man about history and the material world is a "speechless idol" (Habakkuk 2:18), not the Maker of heaven and earth "who teaches man knowledge" (Psalms 94:10). The mute god would be a finite god, leaving impersonal matter as an ultimate, self-existent force in the universe; so once again ID advocates leave us with a naturalistic worldview.

Aside from the theological problems, Dembski and Meyer's definition of science faces the problem that philosophers of science have failed to establish a line of demarcation between science and religion. Inconsistently, Meyer argues against the naturalistic critics of ID by noting that the attempt to find a line of demarcation between science and religion has been a spectacular failure,[14] yet he and Dembski invoke a demarcation rule to exclude God and the Bible.

The bankrupt epistemology of secular empiricism

The failure of the demarcation criterion between science and religion is part of the general failure of secular epistemology. We have seen that the ID leaders appeal to both (at least when it is convenient), so unless they are going to offer something better than what the best secular philosophers have attempted, which they have not, their view of scientific epistemology must be considered a failure as well. The ID leaders are standing on sinking sand to rely on bankrupt, secular epistemology to defend ID. *By keeping the sovereign God of Scripture out of science, ID leaders put themselves in the position of denying a source of rational unity that extends to all the particular facts of experience,*

which puts them in the indefensible epistemological position of explaining how particular facts without unity between them can be intelligible. A brief review of why secular empiricism fails to provide a basis for science will highlight the problem that the ID leaders face in their opposition to bringing God and the Bible into science. The current status of secular epistemology, particularly secular empiricism, is captured by twentieth-century philosopher Bertrand Russell's denial that we can know anything whatsoever:

> "That scientific inference requires, for its validity, principles which experience cannot even render probable is, I believe, an inescapable conclusion from the logic of probability … . To ask, therefore, whether we 'know' the postulates of scientific inference is not so definite as it seems … . In the sense in which 'no' is the right answer we know nothing whatsoever, and 'knowledge' in this sense is a delusive vision. The perplexities of philosophers are due, in a large measure, to their unwillingness to awaken from this blissful dream."[17]

Russell came to recognize that naturalistic empiricism provides no basis for saying that there is a world at all:

> "Academic philosophers, ever since the time of Parmenides, have believed that the world is a unity … . The most fundamental of my intellectual beliefs is that this is rubbish. I think the universe is all spots and jumps, without any unity, without continuity, without coherence or orderliness or any of the other properties that governesses love. Indeed, there is little but prejudice and habit to be said for the view that there is a world at all."[18]

We can go back to David Hume to understand the *reductio ad absurdum* of attempts to justify causation and scientific knowledge on the basis of naturalistic empiricism. Hume saw that with sense impressions as the basis of all knowledge, there is no unity to the world. Nothing can be said to exist but the discrete moment. That a sequence of perceptions reflects a cause-and-effect relationship between external objects cannot be known from experience. Any *necessity* that might connect external objects that are perceived is not itself a perception, so the assumption of cause-and-effect necessity in the interaction of external objects is unwarranted. Abstract concepts like laws and logic are applied by the human mind to perceptions but they themselves are not perceptions. They all involve continuity over time but bare experience gives us nothing but the discrete moment. Since we have no experience of the future, experience itself provides no basis for believing that the future will be anything like the past. When "we form any conclusion beyond those past instances, of which we have had experience", Hume says, using his theory of strict empiricism, our reasoning has "no just foundation".[19]

Even the concept of the self is undermined by strict empiricism since there is no one perception that lasts as long as the self allegedly does. When he sleeps, Hume says that he "may truly be said not to exist".[20] With no permanence to the self, knowledge and memory of the past, including one's own past existence, is inconsistent with the claim that all knowledge is through sense experience. Hume was logically rigorous in reasoning from his assumptions, but this led him to an absurd conclusion. On the basis of Hume's empiricism, we can have knowledge of neither the external world nor our inner selves, neither the past nor the future. Hume's view of knowledge does not allow for laws of logic, laws of nature, or repeatability of experiments.

Hume resorted to custom and habit as explanations for our belief in the regularity of nature,[21] but custom and habit themselves presuppose continuity over time, and discrete experience can provide no basis for continuity over time.[22] Hume lamented that the "cold, and strain'd, and ridiculous" conclusions of his philosophical reasoning gave him "philosophical melancholy and delirium".[23] A history of secular epistemology since Hume would be instructive, although space does not allow it.[24] Nevertheless, Bertrand Russell's statements from the mid-twentieth century quoted above, that there is no basis for saying that the world has unity or even that the world exists at all, indicate that the problems with secular empiricism that Hume uncovered have not been overcome since then.

Part 2—an explicitly Christian theory of knowledge

The ID leaders provide no solution to the failure of secular philosophy of knowledge. Indeed, they join themselves to the failed epistemology of the secularists in order to gain their favour. Even if they wanted to, ID advocates can never conclude with the existence of the sovereign Creator of the Bible by combining evidence for design with the epistemology of naturalistic empiricism. The way out of the problem is the assumption of the creationists that the ID advocates reject: metaphysical and methodological theism, recognizing that science is dependent on God and His revelation, rather than trying to reason from a supposedly theologically neutral scientific methodology. Although this approach is a rejection of Dembski's theological minimalism that he calls "mere creation", it achieves one of the goals of his doctrine of "mere creation", which is: "A sustained theological investigation that connects the intelligence inferred by intelligent design with the God of Scripture and therewith formulates a coherent theology of nature."[25] Hopefully this essay will further this goal of his.

The solution to the modern crises of justifying knowledge and rationality is the Transcendental Argument for the existence of God (or TAG) formulated by Cornelius Van Til.

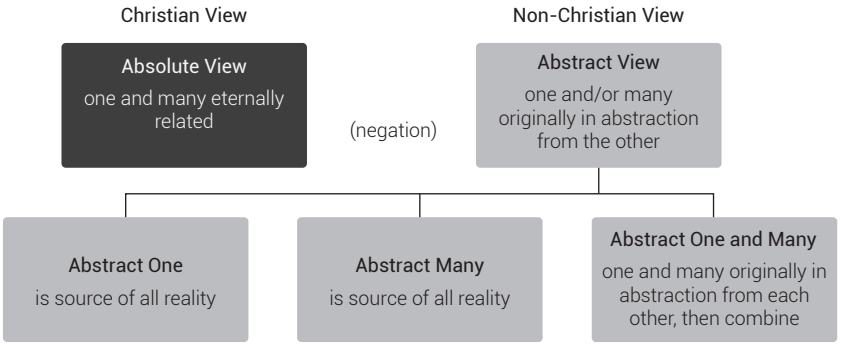

Figure 2. Christian vs non-Christian view of unity and diversity

TAG is an explicitly theistic theory of knowledge, or you might call it theory of fact; therefore it applies to all facts in the world, whether stones or watches. The argument is that the existence of God, an absolute God who is the source of all that exists, necessarily exists in order for knowledge to be possible. Van Til defines an absolute God, which he also calls a "concrete universal" God, as one who is the source of both the diversity of all the particular facts of the world and the unity of the concepts that apply to them. Unity and diversity must be eternally related to each other in the mind of God, because:

1. "An abstract diversity is chaos, which is irrational.
2. An abstract unity is a pure emptiness, which cannot be an object of thought either.
3. The two irrational principles cannot be combined to produce a rational world, where human knowledge, intelligible experience, etc. are possible."[26]

Compare Van Til's approach to Dembski's description of Complex Specified Information (CSI):

> "(1) Chance generates contingency, but not complex specified information. (2) Laws … generate neither contingency nor information, much less complex specified information. (3) … no chance-law combination is going to generate information either. After all, laws can transmit only the CSI they are given, and whatever chance gives to a law is not CSI. Ergo, chance and laws working in tandem cannot generate information."[27]

They both recognize that information cannot be the product of combining chance and law. Just as Van Til affirms that knowledge must be eternal because knowledge can only come from knowledge, Dembski affirms: "Information is *sui generis*. Only information begets information."[28] Therefore information must be *eternal* according to Dembski's reasoning. Information requires both order and diversity, or "specified complexity" as Dembski calls it, and he recognizes that merely adding chance and law cannot produce specified complexity.

Van Til's phrase that closely parallels Dembski's specified complexity is "concrete universal"[29] (see table 1). Van Til argues that a concrete universal God is necessary for the possibility of intelligible experience. This means that the unity of experience (i.e. the 'universal') and the diversity of experience (i.e. the 'concrete') must be eternally related to each other. He notes: "Every intellectual effort deals with facts in relations and with relations in facts."[30] As postmodernists have put it, all facts are interpreted facts.[31] Facts unrelated to concepts and concepts without content (unrelated to particular facts) are both meaningless, and the two meaningless notions cannot combine to create knowledge. Every particular fact and every universal that applies to every fact are eternally related to each other in the mind of God. Knowledge can only come from knowledge. Human knowledge must be "receptively reconstructive" of God's original knowledge; humans are not originally constructive of knowledge as the atheists contend. [32] Humans are made in the image of God, thus our knowledge is a reflection of God's knowledge, meaning that human knowledge can be true but not exhaustive like God's.[33]

The difference between Dembski and Van Til here is that Dembski is addressing the narrower topic of information, which applies to a watch but not a stone. Van Til is addressing the broader topic of intelligibility, which applies to any fact, whether a watch or a stone. However, Dembski touches on the issue of intelligibility in his aforementioned chapter where he drops his idolatrous praises of finite gods and sees something of the necessity of the biblical view of God for the possibility of science. He makes this observation that is in harmony with Van Til's philosophy:

> "God, in speaking the divine *Logos*, not only creates the world but also renders it intelligible … . Einstein claimed: 'The most incomprehensible thing about the world is that it is comprehensible.' This statement, so widely regarded as a profound insight, is actually a sad commentary on naturalism. Within naturalism the intelligibility of the world must always remain a mystery. Within theism, on the other hand, anything

Table 1. Comparison between God's rational nature, per Van Til, and information, per Dembski

	Plurality	**Unity**	
Van Til	Concrete	Universal	(God)
Dembski	Complex	Specified	(Information)

other than an intelligible world would constitute a mystery."[34]

So, despite all of my criticisms of Dembski, there is hope for him yet.

Revelational epistemology—empiricism and rationalism under God and for science

A Christian theory of knowledge must begin with an all-knowing God as the source of all the facts of the universe and the human mind's ability to know the world that God made.[35] Human sense experience and the human mind are part of that picture, but not the whole picture. To treat either one or both of them as the whole picture would be to make an idol out of an aspect of God's creation. God is the source of the whole picture, and unity and diversity are equally ultimate in God, as the orthodox doctrine of the Trinity demands. God's diversity, the three persons, cannot be denied, leaving God's nature an abstract unity. There is genuine particularity in God. Nor can God's unity be denied in favour of a polytheism of three different gods.[36]

Here, in the nature of God as the absolutely rational, all-knowing, ontological Trinity we have the solution to the secularist's problem of knowledge. The Christian does not need to futilely struggle, like Einstein, to explain how an ultimately non-rational universe produced rational, finite creatures able to gain knowledge of their world. Christianity assumes knowledge from the beginning—the eternal knowledge of God. On the assumption of a Christian-theistic epistemology, explaining human knowledge is not the problem that it is in non-Christian views, of trying to rationalize the irrational, trying to create knowledge from the chaotic diversity of sense perceptions that have no connection between them. All knowledge exists eternally in the mind of the omniscient God who planned out everything that would happen before there was a world. Facts and their relation to other facts are eternally determined by the mind of God. We can call this a *revelational epistemology*, in contrast to empiricism and rationalism.[37] However, this revelational epistemology allows for knowledge through sense experience and reason. Empiricism cannot get beyond sense perception to knowledge of the external world because it views knowledge as ultimately beginning with sense perception. But because the Christian sees knowledge as ultimately beginning with a lawful, rational God who created and controls the world, the Christian is justified in saying that there is a lawful reality beyond our senses. Since God is the origin of both rational laws and individual facts, the Christian is justified in using his reasoning to apply universal laws to the changing world of sense experience. Assuming the existence of God, Christians have justification for the repeatability of experiments, for the uniformity of nature, and for the abstract rules of logic and math applying to the changing world of sense experience. Finite intelligence requires an absolute Mind in order to function.[38]

This view of knowledge is consistent with what scriptures teach us, such as: "The fear of the Lord is the beginning of knowledge" (Proverbs 1:7). It is "in your light do we see light" (Psalms 36:9). Rather than "hollow and deceptive philosophy" based on "the basic principles of this world", the Christian is to recognize that "in Christ are hidden all the treasures of wisdom and knowledge" (Colossians 2:8). This knowledge cannot be limited to spiritual and heavenly matters; it must be comprehensive, including all creation and all history, because God is the sovereign Creator and Ruler of all things. [39]

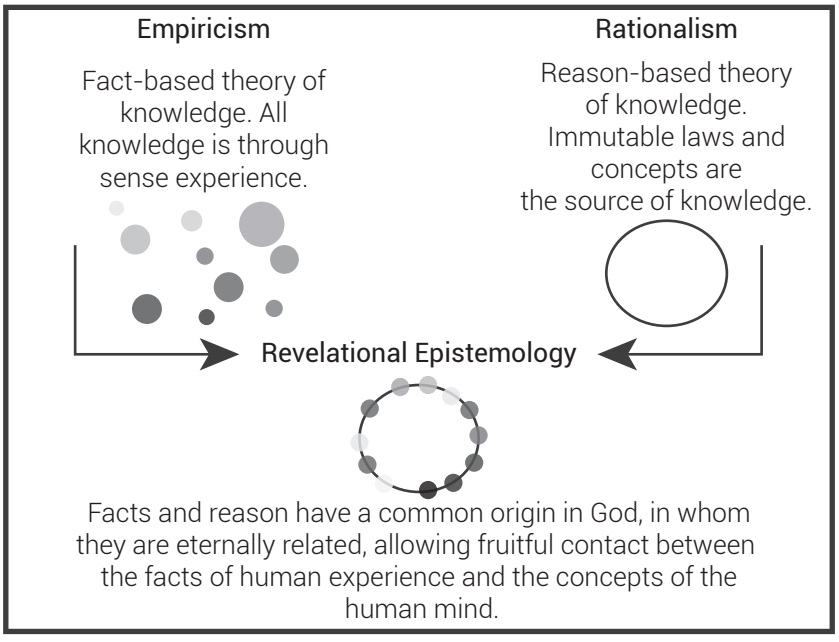

Figure 3. Empiricism, rationalism, and revelational epistemology

Why science needs the Bible

An absolute God can only speak with absolute authority and, as absolute, that authority must extend to all areas of life, including science. An absolute Bible is entailed by an absolute God. The Bible must be regarded as absolutely trustworthy when it intends to speak literally about

physical features of the world and the events of history. Of course, humans can distort God's message but there is no necessity to it when God has absolute rule over His creatures. And this is not to deny that the Bible can use figurative language and common jargon in the culture that is not meant to be scientifically accurate. If the ID advocates want to argue that Genesis 1 is meant by its author to be a poetic depiction of atemporal truths rather than a literal record of creation, that's another issue, although I disagree with them.[40] The leading ID advocates that I quoted don't want the Bible to speak with *any* authority on scientific matters, regardless of whether the Bible teaches a young earth or if it allows for billions of years. Since God knows more than any human can ever know, being the source of all knowledge and all facts, scientists are rationally obligated to fit observations to conform to the teachings of Scripture. Therefore, *if* the Bible teaches that God created the world in six literal days about six thousand years ago, ID advocates and all other scientists are rationally and morally obligated to conduct their scientific investigation controlled by that assumption.

Additionally in support of biblical authority in science, since man has rebelled against God, and God rules over all things, then rebellion against God will manifest itself in all areas of life, including science. Romans 1 says that all men "by their unrighteousness suppress the truth" (Romans 1:18) and that truth specifically includes that nature reveals an eternal Creator. Therefore we would expect that God's redemptive revelation, the Bible, would give us information to correct the sinful reasoning of men about creation and God's role in it. The doctrine of human depravity is not a denial that non-Christians can observe their world and gain all sorts of knowledge about it, often better than Christians. But their God-suppressing mindset leads them to distort their interpretation of what they see in varying degrees, especially when they are aware that an issue involves the existence of God and His demand that they submit to Him. They invent theories with the intent to exclude God, like naturalistic evolution; and then in their isolated focus on that theory, they pretend that they are doing religiously neutral scientific investigation.

Since we humans are finite and our minds are corrupted by sin, we would benefit from clear, written information about the origin of the world that an all-knowing God might be gracious enough to tell us. Ignoring God's Word is not a religiously neutral position to take. God doesn't like it (Matthew 7:21–27; Luke 6:46–49). And specifically, *to ignore the information given in God's redemptive revelation, the Bible, is to implicitly reject the Fall and its noetic effects on man*.

Van Til points out that even before the Fall, God saw it necessary to give man special revelation to properly understand the world.[41] Man was never intended to interpret nature apart from special revelation. If even before the Fall man needed special revelation to properly understand the world, how much more after the Fall, when man's sinful mind suppresses the knowledge of God. Man needs his presuppositions corrected by the special revelation of God. As Calvin famously put it:

> "For as the aged, or those whose sight is defective, when any book, however fair, is set before them, though they perceive that there is something written are scarcely able to make out two consecutive words, but, when aided by glasses, begin to read distinctly, so Scripture, gathering together the impressions of Deity, which, till then, lay confused in our minds, dissipates the darkness, and shows us the true God clearly."[42]

The ID advocates protest that they don't need an eye doctor to give them a glasses prescription, and even atheist scientists only need a slight refocus, but they certainly don't need a prescription for those nerdy Bible glasses. But they are as self-deceived as the Pharisees (Matthew 9:12). Natural theologians are mistaken to appeal to the 'book of nature' and 'book of Scripture' as independent and equal sources of knowledge.

Conclusion

In summary, to be true to science and Scripture, ID advocates ought to recognize the necessity of the biblical God for the possibility of any scientific knowledge, whether that is of complex designs in nature or the stone that stubs their toe in a field. They need to recognize that unbelieving scientists can only gain scientific knowledge because, despite what they claim, there is a God who created them and their world, and the unbeliever is acting inconsistently with what his worldview allows when he pursues scientific knowledge. Redemption in Christ is redemption unto true knowledge of God and God's world. Christ redeems creation by redeeming human beings to think God's thoughts after Him in respect to His creation. The resurrection of Christ is the resurrection of science—under Christ's lordship, like everything else in heaven and earth. Our message to non-Christian scientists must be the following, as stated by Van Til:

> "The non-Christian scientist must be told that he is dealing with facts that belong to God. He must be told this, not merely in the interest of religion in the narrower sense of the term. He must be told this in the interest of science too, and of culture in general. He must be told that there would be no facts distinguishable from one another unless God had made them and made them thus. He must be told that no hypothesis would have any relevance or bearing on these same facts, except for the providence of God. He must be told that his own mind, with its principles

of order, depends upon his being made in the image of God. And then he must be told that if it were not for God's common grace he would go the full length of the principle of evil within him … . 'Will you not then repent in order to serve and worship the Creator more than the creature?'"[43]

References

1. A version of this paper was presented 11 April 2015 at the 2015 Southwest Regional Meeting of the Evangelical Philosophical Society.
2. Paley, W., *Natural Theology*, American Tract Society, New York, p. 2, 1881.
3. Paley, ref. 2, p. 1.
4. Pearcey, N., Christianity Is a Science-Starter, Not a Science-Stopper, *The Pearcey Report*, 22 September 2005, www.pearceyreport.com/archives/2005/09/post_4.php. This reveals the mistake of atheists like Richard Dawkins who claim that atheism is on the opposite end of the theological continuum from polytheism, with Christianity in the middle, because Christianity denies all gods but one, and atheism just denies one more. Atheism and polytheism are both children of the naturalistic worldview, and Christianity stands opposed to the naturalistic root of both their views.
5. Whitehead, A.N., *Science and the Modern World*, The Free Press, New York, pp. 12–13, 1997.
6. Torrence, T., *Divine and Contingent Order*, Oxford University Press, Oxford, p. 67, 1981.
7. Johnson, P.E., *The Wedge of Truth: Splitting the Foundations of Naturalism*, InterVarsity Press, Downers Grove, IL, p. 13, 2000.
8. Dembski, W., *Intelligent Design: The Bridge Between Science & Theology*, IVP Academic, Downers Grove, IL, p. 16, 1999.
9. Dembski, W., preface; in: Dembski, W. (Ed.), *Darwin's Nemesis: Phillip Johnson and the Intelligent Design Movement*, IVP, Downers Grove, IL, pp. 17, 20, 2006.
10. Dembski, ref. 8, p. 252.
11. Directed panspermia is the view that advanced civilizations on other planets deliberately spread life to earth. See Sagan, C. and Shklovsky, I., *Intelligent Life in the Universe*, Holden Day, San Francisco, CA, 1966; Crick, F. and Orgel, L., Directed Panspermia, *Icarus*, Vol. 19, 1973, profiles.nlm.nih.gov/SC/B/C/C/P/_/scbccp.pdf; Hoyle, F. and Wickramasinghe, C., *Evolution from Space*, Touchstone, 1984. Richard Dawkins supports the view in his interview in the documentary *Expelled: No Intelligence Allowed*, DVD, Premise Media Corporation, USA, 2008.
12. Dembski, ref. 8, p. 226.
13. Dembski, ref. 8, p. 248.
14. Meyer, Stephen C., The Scientific Status of Intelligent Design: The Methodological Equivalence of Naturalistic and Non-Naturalistic Origins Theories, www.discovery.org/a/2834, accessed 5 July 2015.
15. Dembski, ref. 8, p. 249.
16. Meyer, S.C., Intelligent Design is not Creationism, *The Daily Telegraph*, London, 9 February 2006, www.discovery.org/a/3191, accessed 5 July 2015.
17. Russell, B., *Human Knowledge: Its Scopes and Limits*, Clarion Books, Simon and Schuster, New York, pp. xv–xvi, 1948; quoted in Bahnsen, G., Pragmatism, Prejudice, and Presuppositionalism; in: North, G. (Ed.), *Foundations of Christian Scholarship*, Ross House Books, Vallecito, CA, p. 243, 1976.
18. Russell, B., *The Scientific Outlook*, George Allen & Unwin Ltd., London, p. 98, 1954.
19. Hume, D., *A Treatise of Human Nature*, Oxford University Press, Oxford, p. 91, 1978.
20. Hume, ref. 19, p. 252.
21. Hume, ref. 19, p. 21–24.
22. Hume points out, by the way, that to claim that nature is "probably" orderly simply begs the question because probability itself assumes order, which perception alone cannot provide. Hume, ref. 19, p. 90.
23. Hume, ref. 19, p. 269.
24. See Bahnsen, G.L., *History of Western Philosophy* (audio lecture series), www.cmfnow.com/historyofphilosophyinaflash.aspx, accessed 5 July 2015.
25. Dembski, W., Introduction: Mere Creation, in *Mere Creation*, InterVarsity Press, Downers Grove, IL, p. 29, 1998; also see Dembski, ref. 8, p. 295, where he suggests a dissertation on the topic of "the logic of explanation connecting intelligent design and the Christian doctrine of creation."
26. See, for example, Van Til, C., *Christianity and Barthianism*, Presbyterian and Reformed Publishing Co., Phillipsburg, NJ, pp. 204–205, 1962; and *A Survey of Christian Epistemology*, Presbyterian and Reformed Publishing Co., Phillipsburg, NJ, pp. 38, 42–43, 1969.
27. Dembski, ref. 8, p. 167–168.
28. Dembski, ref. 8, p. 183.
29. Van Til, C., *The Defense of the Faith*, Presbyterian and Reformed Publishing Co., Phillipsburg, NJ, p. 42, 1955. He uses 'absolute', 'concrete universal', and 'Eternal One and Many' as equivalent phrases.
30. Van Til, C., *Common Grace and the Gospel*, The Presbyterian and Reformed Publishing Company, Nutley, NJ, pp. 37–38, 1977.
31. In his famous essay, Two Dogmas of Empiricism, Willard Van Orman Quine refuted the distinction between analytic statements (true by definition) and synthetic statements (true from experience), arguing that science is "underdetermined by experience". Quine, W.V.O., *From a Logical Point of View*, Harvard University Press, p. 45, 1961. In the ground-breaking book *The Structure of Scientific Revolutions*, University of Chicago Press, Chicago, 1996, Thomas Kuhn argues: "Scientific theory and fact are not categorically separable" (p. 7), and that scientific "operations and measurements are paradigm-dependent" (p. 126).
32. Van Til, C., *Introduction to Systematic Theology*, Presbyterian and Reformed Publishing. Company, Phillipsburg, NJ, p. 126, 1974.
33. Van Til, ref. 32, p. 168; Van Til, C., *The Reformed Pastor and Modern Thought*, The Presbyterian and Reformed Publishing Company, Phillipsburg, NJ, chs. 2 and 4, 1971.
34. Dembski, ref. 8, p. 230.
35. Bahnsen, G., *Always Ready: Directions for Defending the Faith*, Covenant Media Foundation, Texarkana, AR, ch. 5, 1996.
36. Van Til, ref. 32, p. 229.
37. Van Til, *A Survey*, ref. 26, pp. 1, 6–10.
38. Anderson, J.N. and Welty, G., The Lord of Non-Contradiction: An Argument for God from Logic, *Philosophia Christi* **13**:2, 2011.
39. Bahnsen, G., The Reformation of Christian Apologetics; in: North, G. (Ed.), *Foundations of Christian Scholarship*, Ross House Books, Vallecito, CA, pp. 208–220, 1976.
40. See Pipa, Jr, J.A. and Hall, D.W. (Eds.), *Did God Create in 6 Days?*, Tolle Lege Press, White Hall, WV, 2005; Sandlin, A. (Ed.), *Creation According to Scriptures: A Presuppositional Defense of Literal, Six-Day Creation*, Chalcedon, 2001; Batten, D. (Ed.), *The Creation Answers Book*, Creation Book Publishers, ch. 2, Six Days? Really?, creation.com/images/pdfs/cabook/chapter2.pdf, and ch. 10, Was the Flood Global creation.com/images/pdfs/cabook/chapter10.pdf, 2007. Sarfati, J., Biblical chronogenealogies, creation.com/biblical-chronogenealogies.
41. Van Til, ref. 30, p. 69.
42. Calvin, J., *The Institutes of the Christian Religion*, I.VI.I., Smith and Co., Edinburgh, p. 64, 1863.
43. Van Til, ref. 30, p. 145.

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Genesis as ancient historical narrative

Lita Cosner

The three authors contributing to *Genesis: History, Fiction, or Neither?* all adopt a non-historical view of Genesis 1–11 to some extent. However, an analysis of the genre of Genesis based on its grammar and its usage in the rest of Scripture shows that it is historical narrative and should be interpreted as such.

Genesis: History, Fiction, or Neither? (figure 1)[1] is part of the 'Counterpoints' series, which features essays from three views, with a short response to each essay from the two other contributors. It is intended to be a useful format to compare and contrast differing theological views. The three contributors were asked to do the following:

> "1) identify the genre of Genesis 1–11; 2) explain why this is the genre of Genesis 1–11; 3) explore the implications of this genre designation for biblical interpretation; and 4) apply their approach to the interpretation of three specific passages: the story of the Nephilim (6:1–4), Noah and the ark (6:9–26), and the Tower of Babel (11:1–9)" (p. 20).

The three contributors were James Hoffmeier, Gordon Wenham, and Kenton Sparks. As Wenham noted in his response to Hoffmeier's essay:

> "On the one hand, none of us is defending an extreme literalist view that requires us to regard the days of Gen 1 as 24 hours long, or like Jewish tradition and Archbishop Ussher use the ages of the patriarchs to establish the date of creation. On the other hand, none of us holds that these chapters are just fiction, that is, tales based solely on the imagination of some ancient Israelite. We are all somewhere in between" (p. 59).

This is very useful if one is deciding which flavour of compromise on the biblical text to adopt, but it would have been much better if they had actually enlisted a biblical creationist to give his or her view on the text. Then we would have been treated to a three-way debate between a biblical creationist, a compromising Christian (either Hoffmeier or Wenham), and a heretic unbeliever (Kenton Sparks, who has explicitly stated that he believes Jesus erred in His understanding of Scripture[2]).

Therefore, rather than simply reviewing the essays of Hoffmeier, Wenham, and Sparks, I will undertake the same task that they did, from a biblical creationist viewpoint. I am confident that a biblical creationist view not only does better justice to the text of Genesis, but is more consistent with the views of the later biblical authors and Christ Himself. At the same time, I believe it can stand the test of scholarship, if dogmatic materialism is not held to be an absolute prerequisite for critical scholarship.

What is the genre of Genesis?

Wenham and Hoffmeier resist plainly stating their view of the genre of Genesis. Hoffmeier rejects the classifications of 'legend' and 'myth', and believes that Genesis 1–11 is historical in some sense. He says:

> "By using the formula 'this is the family history', the author or compiler signals the genre of the book of Genesis, including chapters 1–11. Even if we concede that earlier records were used, the 'family history' structuring of the book indicates that the narratives should be understood as historical, focusing on the origins of Israel back to Adam and Eve, the first human couple and parents of all humanity. The use of a genealogical-historical framework for Genesis points the reader toward how the book as a whole should be understood, namely, the narratives are dealing with real events involving historical figures—and this includes Genesis 1–11" (p. 32).

Biblical creationists can agree with this paragraph as far as it goes. However, Hoffmeier is unable to commit to defending the complete historicity of Genesis, including its timeframe and its 6-day creation account. This leaves him vulnerable to attack from Sparks, in particular, who harshly criticizes Hoffmeier's evasiveness in his response.

> "If the author of Genesis used mythical imagery, as Hoffmeier has suggested, then which images are mythic symbol and which are closer to historical representation? Does Hoffmeier believe that the cosmos was created in six literal days? Does he believe that the first woman was made from Adam's rib? Does he believe that a serpent spoke in the garden? Does he believe that our broken human condition can be traced back to eaten pieces of fruit? Does he believe in giants who roamed the pre-Flood earth? Does he believe in a literal world-wide flood, and a boat with animals? Does he believe that God created rainbows to remind himself not to destroy us again? And how does all of this relate to what is now public knowledge about human origins, which emerged over millions of years through a long evolutionary process rather than in one literal day? One wonders why Hoffmeier does

not answer these questions when the historicity of Gen 1–11 is the main theme of our discussion" (p. 64).

Wenham agrees substantially with Hoffmeier's analysis of genre:

> "In my view, the book of Genesis is a genealogy with digressions or expansions focusing on key episodes or actors in the story. ... But as I have argued in my essay, I think we need a more nuanced characterization of the genre of Genesis, which I termed protohistory. Otherwise we may be forced to conclude that Genesis is trying to relate history but not succeeding, which would be a rather negative conclusion" (p. 61–62).

In other words, Wenham has come to the text with the assumption that it fails to relate history, so the only way to preserve a high view of Scripture is to find a way of saying that Scripture does not *try* to relate history in this area. But Sparks does not waste time pointing out the inconsistency in Wenham's views:

> "While I can certainly respect a candid admission that the text is historically ambiguous, in this case I question whether Wenham's conclusions are justified. First, in spite of his preference for historical ambiguity, Wenham's description of the narrative as 'literary picture' and denial that it offers 'ordinary history' fits very nicely with what most scholars would call 'fiction'. For as usually conceived, fiction includes any narrative genre that does not closely represent the actual events of history" (105).

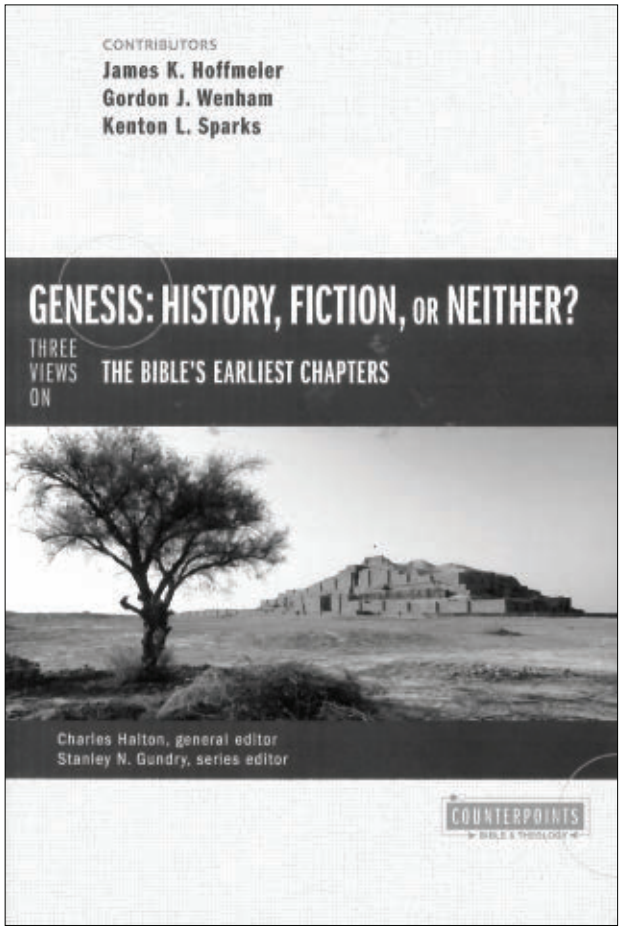

Figure 1. Cover of *Genesis: History, Fiction, or Neither?*

Kenton Sparks believes that evolution proves Genesis is myth. He posits that the author of Genesis believed certain things to be true (like the historical Adam and Eve) that were not, and wrote other things not intended to be taken literally that others mistakenly interpreted as history, in his view. Both Wenham and Hoffmeier are at their best and most interesting when responding to this rank liberalism. Hoffmeier comments:

> "It is hard to disagree with the position that one's interpretation of Scripture should not be verifiably false. My problem is that whenever there is a conflict between the two, Sparks rarely gives Genesis the benefit of the doubt; science is always right, never to be questioned" (p. 140).

Ancient historical narrative: a definition

I identify Genesis 1–11 (indeed, the book of Genesis as a whole), as ancient historical narrative—each word in this term is important. This doesn't dispute that there are poetic elements with the typical parallelism that characterizes Hebrew poetry. However, they always involve someone speaking, e.g. the climaxes in Genesis 1:27 (by God), 2:23 (by Adam), and 4:23–24 (by Lamech). These just reinforce the contrast between the quoted poetry of the speakers and the main narrative text.

'Ancient' reminds us that we cannot impose modern historiographical notions on an ancient text. Just because *we* write history in a certain way does not mean that we can impose those rules on an author writing thousands of years ago. Instead, we must ask, "If an ancient person wanted to write history, how would that look? What grammatical constructions would he employ? What details would he include in the document?"

'Historical' anchors our thoughts on the fact that Moses intended to communicate about actual people, places, and events in history. When he presents Adam and Eve as the first people God created and the parents of all mankind, he is not giving us a metaphor or an 'everyman' parable about why people sin; he is telling us about our actual first parents, back to whom every person can trace his or her genealogy. When he writes about Noah gathering all kinds of animals onto a huge ark to survive a global Flood he is not relating some sort of ancient memory about a really big flood in Mesopotamia; he is telling us about the actual event that

inspired the many flood legends in ancient cultures around the world.

'Narrative' indicates that Moses is telling us these historical events in a story form. This is not the only genre that can encode historical information; in fact, many of the psalms speak in a poetic form about what God actually did for Israel in history. But narrative is the most straightforward genre for historical information, and relates facts in a story form without much symbolic language.

So I will be arguing that Moses wrote Genesis as a document which someone in his day would have understood as relating events that occurred in history, and did so using language that should be interpreted literally, unless the context gives a clear reason to do otherwise.

Indications that Genesis 1–11 is ancient historical narrative

One obvious argument for the historical nature of Genesis 1–11 is that it transitions seamlessly to Genesis 12–50. The latter, sometimes called 'patriarchal' history, is universally understood to be intended as historical narrative—more specifically, the 'origin story' of Israel. Hoffmeier notes the absence of a break between primeval and patriarchal history, and that this was probably intentional (pp. 24–25). While there are obvious contrasts—for instance, Genesis 1–11 covers a vast period of about 1,500 years, while 12–50 covers only a few generations—the book comes together as a unified whole.

Also, Genesis 1–11 tells about people and events that are grounded in time and space. Eden is described in straightforward geographical terms, so presumably before the Flood someone would have been able to locate Eden geographically (Genesis 2:10–14). The chronogenealogies in Genesis 5 and 11 actually allow us to create a timeline from creation to the Flood and beyond. One may argue that Moses is not relating *accurate* geographical or chronological information, but the presence of these markers alerts the reader that this is not a 'fairy tale' or a myth, but claims to be a real-world history.

The grammar of Genesis 1–11 is what we would expect of a historical narrative. One grammatical form that occurs often is the *waw* consecutive, and its purpose "is to present events in a historical sequence. It appears throughout Hebrew narrative, but it is almost non-existent in Hebrew poetry."[3] In Genesis 1, it occurs 51 times.[4] This indicates that the author of Genesis clearly intended to convey a straightforward narrative.

Figure 2. The geographical details in Scripture have been verified by archaeology to be accurate.

The *toledot* structure is another historical marker—Genesis claims to be a family history, tracing the origin of all humanity from Adam, all post-Flood humanity from Noah and his sons, and Israel from Abraham, Isaac, and Jacob. But Genesis only fulfills this explanatory purpose if it relates historical details. If Adam did not *really* sin, what is the basis for the 'offspring' promise (Genesis 3:15; 5:29; 12:3)? If Abraham is not really the descendant of Eber, the descendant of Shem, then who is he? So the author of Genesis intends to talk about people who really existed, and events that actually happened, and he intends the Hebrews to understand their existence as a nation in light of the events that he is recording.

In contrast, there is a lack of poetic or figurative language. "Genesis 1 contains little or no indication of figurative language. There are no tropes, symbolism, or metaphors."[4] It also lacks the most important markers of poetry, namely, parallelism and figures of speech. There are bits of poetry in Genesis, mostly climactic statements (e.g. Genesis 1:27; 2:23; 4:23–24; 9:6), but they are inserted into the overall narrative as direct quotes from a speaker, sometimes God.

Also, when we look at the rest of Scripture, the authors of Scripture unanimously interpret Genesis historically. The authors of the New Testament point back to creation, the Fall, and Noah's Flood as precedents for what God will do in the future. Also, they don't recognize any break between supposed primeval and patriarchal history, since they quote both sections seamlessly (Luke 3:23–38, Hebrews 11:4–38). In fact, Kenton Sparks realizes this, and says that Paul and Jesus were *wrong* to interpret Genesis as history.[2] So for Sparks, even the Son of God cannot be allowed to overrule the current scientific consensus.

Documentary Hypothesis

The Documentary Hypothesis (otherwise known as the JEDP theory) also came up in the three essays. Hoffmeier rejects the documentary hypothesis, specifically in the context of the Flood narrative, showing how a giant chiasm running from 6:10 to 9:19 shows a literary unity (p. 48–51). Wenham says, "The standard Documentary Hypothesis (JEDP) is much too complex to be credible" and favours a simplified Documentary Hypothesis "like that favored in the pre-Wellhausen era" (p. 60). He has also previously noted the large-scale chiastic structure, consistent with a single author or editor.[5] Sparks accepts the Documentary Hypothesis as uncritically as he accepts evolution (but insists on coining his own terms; it is rather annoying to keep remembering that by 'Antiquarian', he really means 'Yahwist', and so on), and excoriates Hoffmeier's conservative view regarding the authorship of Genesis (70).

The Christian coming to the biblical text with the assumption of inerrancy must seriously regard the entirety of the biblical witness that Moses authored the first five books of the Bible (e.g. Ezra 3:2; 6:18; 7:6; Nehemiah 8:1; 9:14; 10:29; Malachi 4:4; Mark 1:44; 7:10; 10:4; 12:26; Luke 2:22; 5:14; 16:29; 20:37; 24:27, 44; John 1:17, 45; 5:46; 7:19; Acts 15:21; 26:22; 28:23; Romans 10:5; 1 Corinthians 9:9; 2 Corinthians 3:15; Hebrews 7:14). While there may have been *limited* editorial additions (for instance, adding the account of the death of Moses to the end of Deuteronomy, probably by Joshua), the only biblical candidate for the author of the Torah is Moses. So if Moses did not write the Torah, but it was the result of different sources much later, the Bible is wrong. Sparks is no inerrantist, so this is not a concern for him, but it should be a concern for any faithful Christian.

However, the concepts of inerrancy and inspiration of Scripture do not exclude the possibility that *Moses* used pre-existing sources. In fact, the internal evidence of Genesis suggests the use of pre-existing sources. Pre-Flood geography is given in detail, while these landmarks would have been obliterated by a global Flood. The patriarchal narratives cite cities that were prominent in Abraham's day, but not Moses'. For example, Genesis 10:19 says, "The territory of the Canaanites extended from Sidon as you go toward Gerar, as far as Gaza; as you go toward Sodom and Gomorrah and Admah and Zeboiim, as far as Lasha." This points to an original document written when these cities, some of which were long destroyed by Moses' time, were helpful landmarks. Thus, it is not inconceivable that there were some sort of written records passed down and preserved.

Yet, even though there is internal evidence of pre-existing sources, Moses obviously was crafting the narrative. It shows many marks of unity, such as the chiasms and repeated themes. The end result is that "... the rhetorical features of Gen. 1–11 are so distinctly woven into one tapestry as to constitute an unassailable case for the unity of the section, and most likely composition by a single hand."[6]

Is Genesis a myth?

When discussing the genre of Genesis, each of the contributors discusses whether it is appropriate to call Genesis a 'myth'. As Hoffmeier notes, there is no consensus as to how the word 'myth' should be defined (27), so whether one defines Genesis as a 'myth' depends a lot on the definition. However, it seems that to call Genesis a myth would make the term meaningless. Genesis is grounded in time and space, claims to talk about real people, places, and events, and claims that they have real explanatory power for our experience today. Genesis is not myth; it claims to be an etiology—and it can only function in that way if it is *history*.

The account of the Nephilim as ancient historical narrative

The first passage the contributors were asked to examine as a case study was Genesis 6:1–4; the account of the Nephilim. The identity of the 'sons of God', 'daughters of men', and 'Nephilim' has already received a thorough creationist treatment elsewhere,[7] so this essay will focus specifically on aspects that indicate that the passage is ancient historical narrative.

The passage occurs directly after Adam's genealogy, which gives a straightforward lineage of descendants, as well as a directly implied chronology. It is not a stretch to characterize the genealogy as an account of the multiplication of mankind on the earth. Then Genesis 6 begins, "When men began to multiply on the face of the land" (6:1). So there is a continuity in the narrative, and it is placed within the same history as the genealogy. There are also distinct chronological markers in the passage itself—Yahweh states, "My Spirit shall not abide in man forever, for he is flesh: his days shall be 120 years" (6:3). This allows us to place this statement specifically 120 years before the Flood—in other words, Noah would have been 480 years old at the time of this pronouncement, and his first son would not have been born for another twenty years. Genesis 6:4 states, "The Nephilim were on the earth in those days, and also afterward"—again, giving a timeframe for the existence of the Nephilim. Mythological writing is not normally marked with this sort of chronological precision.

The passage has an explanatory function: the account is an example of the wickedness that caused Yahweh to judge the entire world by the Flood. It also has grammatical markers of historical narrative—the four verses have five *waw* consecutives.

The New Testament includes several passages that are very helpful to us in interpreting this passage as history. In 2 Peter, when Peter wants to assure his readers that God will judge the ungodly and preserve believers, he draws some historical parallels to show how this happened in the past (2:4ff). First, God cast disobedient angels into Hell and chained them to await judgment, as well as deluging the world, but saved Noah and his family. Second, He judged Sodom and Gomorrah but saved righteous Lot.

We do not specifically have the image of chained angels in the Old Testament, but the Book of Enoch shows that Peter must be referring to the judgment of the angels, otherwise known as 'sons of God', who married human women and had children with them. Enoch 10:15 says, "To Michael likewise the Lord said, Go and announce his crime to Samyaza, and the others who are with him, who have been associated with women, that they might be polluted with all their impurity. And when all their sons shall be slain, when they shall see the perdition of their beloved, bind them for seventy generations underneath the earth, even to the day of judgment, and of consummation, until the judgment, the effect of which will last forever, be completed."

This also shows why the judged angels in Peter's list do not have their own contrasting saved individual. The judgment on the angels and the world happened at the same time, and Noah and his family were the individuals preserved from the judgment.

Jude likewise cites three examples of God's judgment: God brought his people out of Egypt but destroyed those who didn't believe (1:5); He chained angels in gloomy darkness who left their proper position (1:6); and He burned Sodom and Gomorrah, "which likewise indulged in sexual immorality and pursued unnatural desire" (1:7). Sodom and Gomorrah's sin is said to be analogous to the sin of the angels—meaning that the angels' sin had to do with unnatural sexual relations. Clearly Jude, like Peter, believed that the 'sons of God' were angels who married human women,

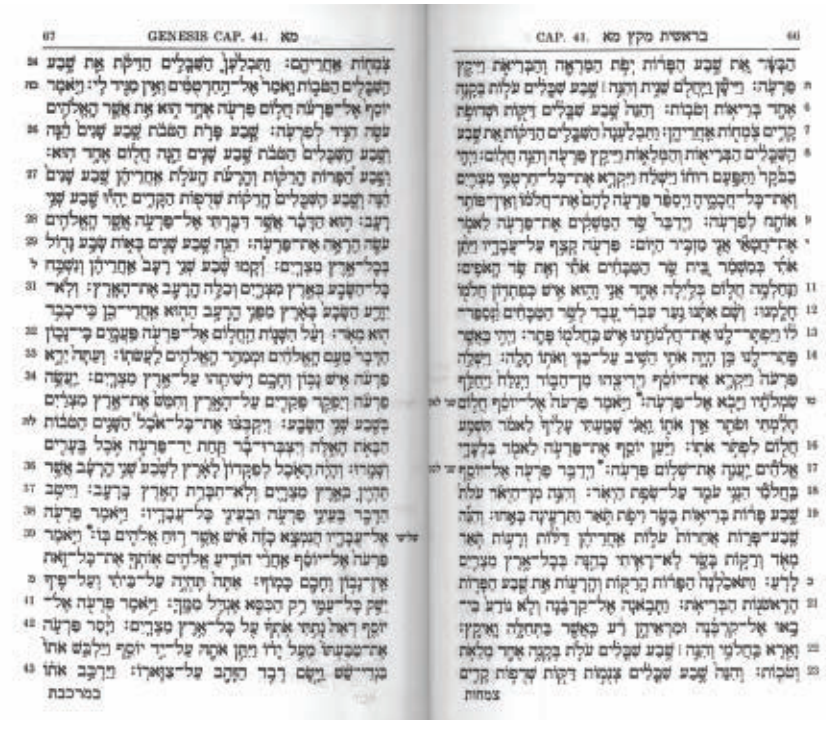

Figure 3. Genesis clearly intends to convey information about historical people, places, and events.

and that this was one of the sins that caused God to send the global Flood in Noah's day.

It is important that both Peter and Jude assert that God's judgment on the angels who sinned was a real event. If God did not really judge sinning angels, it would make no sense for them to cite it as a precedent of God's judgment of sin. So if one interprets this as a myth or in an unhistorical sense, we have a serious problem when we come to the New Testament text, which interprets it in a historical sense.

Wenham has previously supported the above view, stating:

> "The 'angel' interpretation is at once the oldest view and that of most modern commentators. … The Sethite interpretation, for a long time the preferred Christian exegesis, again because it avoided the suggestion of carnal intercourse with angels, has few advocates today."[8]

Noah and the Ark as ancient historical narrative

The second case study is Genesis 6:9–9:28, which includes the story of Noah and the Flood as well as the account of Noah's drunkenness, Ham's sin, and the curse of Canaan. It is impossible to give a thorough treatment to such a large passage in this essay, but it has clear indicators of historicity.

The level of detail in the account is notable. The dimensions and specifications for the Ark are precise, and modelling has shown that the Ark would be a stable vessel.[9] This is in contrast to the vessel in Gilgamesh, which was a cube[10]—a vastly more unstable design—or the 'coracle' ark.[11]

The chronological details are precise, and not all the numbers are obviously symbolic. Noah and his family entered the Ark a week before the Flood came (7:4). The Flood came when Noah was 600, on the seventeenth day of the second month (7:11). The Flood lasted for forty days (7:12), and the water covered the earth for 150 days (7:24). The water receded for 150 days, and the Ark came to rest on the mountains of Ararat on the seventeenth day of the seventh month (8:3–4). The tops of the mountains were visible on the first day of the tenth month (8:5), and Noah began sending the birds 40 days later. In the first day of the first month in Noah's 601st year, the earth was dried out, and on the twenty-seventh day of the second month, they disembarked the Ark (8:13–14). This level of chronological detail is *consistent* with a historical narrative.

The history of Noah and the Flood is intended to be taken as a sort of second 'origin story'. Not only is Israel (and all humanity) descended from the first man Adam, Israel (and all humanity) are also descended from Noah and his sons. The national divisions of the ancient world are explained in terms of descent from Noah's sons (10:1–32).

The New Testament is also full of examples of Noah's Flood as a historical precedent of God's judgment. Jesus says, "For as in those days before the flood they were eating and drinking, marrying and giving in marriage, until the day Noah entered the Ark, and they were unaware until the flood came and swept them all away, so will be the coming of the Son of Man" (Matthew 24:38–39, parallel in Luke 17:27). 2 Peter 2:5–6, discussed above, uses the Flood as a precedent that God will judge the wicked and spare the righteous, and the epistle continues this theme in 2 Peter 3:3–7. Hebrews 11:7 cited Noah as an example of faith in the unseen. Again, these sorts of uses make no sense unless the New Testament authors believed Noah was a historical man and the global Flood was a historical event. And if we say that Noah was not a historical person, or the global Flood was not a global event, we must conclude that the Apostles, and even Jesus Himself, were wrong (as Sparks does).

Tower of Babel

The story of the Tower of Babel is an etiology—it claims to tell us where the modern language divisions come from, since we all are descended from Noah and his sons. The passage is clearly narrative, with ten *waw* consecutives.

The Tower of Babel is geographically and chronologically placed in the 'real world' in the narrative. It took place in the plain of Shinar, and 10:25 tells us that it happened during the lifetime of Peleg.[12] They built the tower using plausible technology for their day, no 'magical' or miraculous intervention would have been required to burn bricks and use bitumen for mortar. Their motive is also believable: they did not want to be separated from each other. The post-Flood population may have felt there was 'safety in numbers'.

However, their intention to stay together was contrary to God's command to Noah and his sons to spread out and fill the earth (9:1). And their intention was to build a tower with its top in the heavens—the intention to trespass the divine realm is clear. So God gives a judgment that simultaneously forces them to obey His command—He confuses their languages.

Is there evidence that the Tower of Babel was a real structure? Ancient writers claimed that it was still standing in their day. We know that it was not beyond the capability of ancient men to build very large structures with limited technology.

Disingenuous and spurious theistic evolutionary arguments

While I have not endeavoured to review *Genesis: History, Fiction, or Neither?* in a conventional way, I cannot fail to mention the serpentine, spurious way that Kenton Sparks argues in this book. Again and again he refers to 'public

knowledge' about evolution and the ancestry of human beings. At no point does he question the evolutionist narrative. In fact, he looks down on Christians who do not blindly accept the evolutionary story.

Curiously, he has a glaring double standard when it comes to the Resurrection:

> "Certainly there are times when detailed, accurate history is called for, but this produces a different kind of representation. When Luke reported that Jesus exited the tomb after his death, he wasn't offering a symbol of our potential for psychological renewal. He intended to say that there was once a particular, very special man named Jesus who died and rose again" (p. 114).

But the very same 'science' that says that God could not create in six days also says that dead people don't rise again. Clearly, 'public knowledge' about the process of death and the decay of corpses isn't as compelling to Sparks as the 'public knowledge' regarding evolution.

Of course, Sparks has a very un-Christian attitude towards Scripture. He says:

> "Scripture is not a room filled with clairvoyant theologians who have the same ideas and agree on every point. It is better understood as a room of wise elders, each an invited guest because of his unique voice and relation to God. Every elder has insight, but no elder has all of the answers, nor are any of them wholly liberated from humanity's broken, sinful condition. Every voice is of value, but each will perhaps push too far in one direction and not enough in another, and each will push, in some way or other, in the wrong direction" (p. 116).

But how is the reader of Scripture supposed to differentiate between where Scripture is correct and where Scripture has been corrupted by humanity's broken, sinful condition? One guesses, by relying on uniformitarian 'science', which Sparks seems to exempt from the influence of sinful humans.

Ancient historical narrative as a superior apologetic stance

Genesis: History, Fiction, or Neither? is instructive in showing how two otherwise solid scholars might go to extraordinary lengths to reconcile the text of Genesis with their compromising views. But such compromise is simply unnecessary: Christians can stand on the biblical foundation of Genesis without embarrassment or apology, and Christ and the Apostles give us an excellent example to follow.

Viewing Genesis as ancient historical narrative—an accurate account of things that actually happened—is the most consistent Christian reading of Genesis, and it allows us to take later authors at their word when they use Genesis assuming that it is history.

References

1. Halton, C. and Gundry, S.N. (Eds.), *Genesis: History, Fiction, or Neither?* Zondervan, Grand Rapids, MI, 2015.
2. Sparks, K., After Inerrancy, Evangelicals and the Bible in the Postmodern Age, part 4, *Biologos* Forum, 26 June 2010.
3. Currid, J.D., *A Study Commentary on Genesis—Volume 1: Genesis 1:1–25:18*, Evangelical Press Study Commentary series, Evangelical Press, Webster, NY, p. 38, 2003.
4. Currid, ref. 3, p. 39.
5. Wenham, G.J., The coherence of the Flood Narrative,*Vetus Testamentum* **28**(3):336–348, 1978.
6. Hamilton, V.P., *The Book of Genesis, chapters 1–17*, The New International Commentary on the Old Testament, Eerdmans, Grand Rapids, MI, p. 29, 1990.
7. See Bates, G., *Alien Intrusion: UFOs and the Evolution Connection,* ch. 7, CBP, 2010.
8. Wenham, G.J., *Genesis 1–15*, Word Biblical Commentary, Vol. 1, Waco, TX, pp. 139–140, 1987.
9. Hong, S.W. *et al.,* Safety investigation of Noah's Ark in a seaway, *J. Creation* **8**(1): 26–36, 1994; creation.com/arksafety.
10. Osanai, N., *A comparative study of the flood accounts in the Gilgamesh Epic and Genesis*, MA Thesis, Wesley Biblical Seminary, US, 2004; creation.com/gilg.
11. Grigg, R., Rebuilding Noah's Ark: getting the facts straight, creation.com/rebuilding-noahs-ark, 12 May 2015.
12. In context, the 'earth' that was divided in Peleg's day is the same as that a few verses later in 11:1: "the whole earth had one language and the same words".

Lita Cosner *earned a B.A. in Biblical Studies (Oklahoma Wesleyan University) and an M.A. in New Testament (Trinity Evangelical Divinity School). Her Master's Thesis is Jesus the Honorable Broker: A Social-Scientific Exegesis of Matthew 15:21–28. She is CMI's full-time Information Officer in the United States office.*

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